DEVELOPING ENERGY RESOURCES: A FIVE POINT PLAN
A Report of the State Annual Forecast of Energy Resources Project

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1	LEAST-COST INTEGRATED PLANNING
2	ENERGY EFFICIENCY
3	NATURAL GAS
4	COGENERATION, SMALL AND INDEPENDENT POWER
5	NEW ELECTRIC UTILITY GENERATION

DEVELOPING ENERGY RESOURCES:

A FIVE POINT PLAN

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THE EXECUTIVE OFFICE OF ENERGY RESOURCES

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Sharon M. Pollard

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I. INTRODUCTION

Overall Objective

The Executive Office of Energy Resources (EOER) is the cabinet level agency of the Commonwealth responsible for developing, coordinating and promoting a comprehensive energy policy for Massachusetts. EOER's primary objective is to develop and implement energy policies and programs which encourage the energy industry to provide adequate and reliable energy supplies and services to meet the Commonwealth's needs and sustain economic growth. Energy supplies must be adequate not only to meet expected needs but also to cover unexpected contingencies, such as higher than expected energy demand growth or the loss of an energy supply source. Cost must also be considered. The energy needs of Massachusetts' citizens, businesses and industries must be met at a reasonable cost. At the same time, environmental impacts must be taken into account. Energy supplies must be developed or acquired in a manner that is consistent with environmental policies and goals.

The Current Situation

The adequacy, reliability, safety, cost and environmental consequences of Massachusetts' and New England's energy supplies have received a great deal of attention in the last few years. Much of this attention has been focused on the region's electricity situation. Analyses conducted for a variety of organizations in Massachusetts and New England have

found that, while there exist a number of resource options capable of meeting the region's electricity and energy needs, it has not been clear how these resources can be effectively and efficiently developed.

Goal of This Report

The goal of this report, **Developing Energy Resources**, is to provide a clear statement of how EOER believes energy suppliers should select and efficiently develop new energy supplies. In it, EOER presents a course of action to be followed by Massachusetts in five key energy policy areas:

1) least-cost integrated planning;

2) energy efficiency;

3) natural gas;

4) cogeneration, small and independent power; and

5) new electric utility generation.

EOER believes that these five policy areas are on the "critical path" for achieving the overall objective of adequate energy supplies for Massachusetts.

II. RECOMMENDATIONS FOR ACTION FOR ADEQUATE ENERGY SUPPLIES

A. LEAST-COST INTEGRATED PLANNING

1. Recommendation for Action

A formal least-cost integrated planning process should be adopted by policymakers and regulators, and implemented by the electric utility industry. This is necessary to identify and develop new power supply resources and new opportunities for using electricity more efficiently and economically. Adoption and implementation of a least-cost integrated planning process -- through selection, approval and development of the energy resource

> options identified -- would ensure that Massachusetts' electricity supplies would be adequate to meet current and future needs, given a range of contingencies, at a reasonable cost and with minimal environmental impact.

"Least-cost integrated planning" is a comprehensive planning process which allows electric utilities to identify which new electricity resources to develop and to determine the order in which they should be developed. Least-cost integrated planning offers utilities, energy planners, policymakers, regulators, the business community and other energy consumers the means to sort through the variety of available electricity resource options: "demand-side" options such as conservation, load management and energy efficiency; "non-utility" options such as cogeneration, small and independent power; and new utility options such as new power plants, "repowering" and life extension of old plants, major transmission facilities, and power purchased from other utilities.

Under a least-cost integrated planning framework all resource options can be systematically evaluated against criteria which have been recognized generally as important and relevant: feasibility and adequacy; reliability; diversity and flexibility; cost; and environmental, economic and social impacts. Such a systematic assessment is necessary to identify and develop the mix of options which will best meet Massachusetts' electricity needs.

2. The Issues

While a broad consensus exists on the various electricity resource options available to meet the Commonwealth's future needs, questions remain about their

feasibility and how to select among them. The challenge is to select those electricity resource options which fare better (or best) on the criteria of adequacy, feasibility, reliability, diversity, flexibility, cost, and environmental, economic and social impacts. The difficulty lies in comparing different options across criteria, e.g., the cost of one versus the environmental impact of another. Moreover, if such a comparison is made and an agreement on a mix of options can be reached at one point in time, how can those most affected -- energy suppliers and consumers -- be assured that this mix will continue to be regarded as desirable over time? It is these dilemmas which adoption of a formal least-cost integrated planning process can resolve.

3. EOER's Proposal

The least-cost integrated planning regulations proposed to the Department of Public Utilities by EOER in June 1988 would require utilities to identify which resource options are feasible; establish the criteria for evaluating them; provide a means for determining what mix of options will best meet these criteria and hence Massachusetts' electricity needs; and address the issue of regulatory uncertainty. EOER's least-cost integrated planning proposal calls for a coordinated review every two years of utilities' electricity plans by the Energy Facilities Siting Council and the Department of Public Utilities. Participation by state energy policymakers and representatives of all those who would be affected by the utilities' plans -- businesses, industries, consumer and environmental groups -- would be encouraged. Such

participation would go far to create consensus on how Massachusetts' utilities, with guidance from policymakers and regulators, will meet the energy needs of the Commonwealth. Utilities would benefit from receiving regulatory approval of their supply plans on a regular basis, with assurances of cost recovery for approved expenditures.

4. Summary

A formal least-cost integrated planning process can play an important role in answering the question of how to identify those energy supply options which should be developed first. The remaining four sections of this chapter discuss what actions should be taken to facilitate the development of specific options to ensure that Massachusetts' energy supplies will be adequate to meet current and future needs, given a range of contingencies, at a reasonable cost and in a manner consistent with environmental policies. EOER has identified ways in which each of these specific resources should be pursued as part of a least-cost energy mix for Massachusetts.

B. ENERGY EFFICIENCY

1. Recommendation for Action

Successfully developing all cost-effective energy efficiency will require aggressive action and comprehensive direct investment by Massachusetts' electric and gas utilities. The Commonwealth should promote a policy and regulatory framework which provides fair and adequate incentives to utilities for such action and investment. In addition, the Commonwealth should continue to adopt and promote all appropriate energy efficiency standards, codes and regulations. These efforts must be undertaken immediately to ensure that energy efficiency opportunities are not lost and that this important resource is developed to help meet both short- and

long-term energy needs.

Efficiency improvements are equivalent to providing energy from power plants -- each kilowatt or kilowatthour conserved means that one less needs to be generated. Energy efficiency, however, offers additional benefits over power plants: it is relatively inexpensive; environmentally clean; highly reliable; contributes to Massachusetts' economic competitiveness by reducing energy costs to business and industry; and creates local employment and investment opportunities. Among all energy resource options, efficiency offers utilities the greatest potential for satisfying future power supply requirements, at a reasonable cost and with minimal environmental and social impacts. Electric and gas utilities can tap this resource through programs which provide information, energy efficient equipment, financial incentives, and technical assistance to encourage customers to make efficiency improvements.

2. Advantages and Opportunities

The primary advantage of energy efficiency is its very low cost, relative to other power supply options, over their lifetimes. This cost advantage argues that efficiency improvements should be developed on their economic merits alone. However, energy efficiency also offers a host of other advantages to utilities, their customers and society generally. These include planning flexibility, minimal environmental impacts, economic benefits such as increased competitiveness, utilization of indigenous resources and local job creation.

Cost-effective energy efficiency opportunities are also widely available. Retrofitting existing buildings and replacing existing appliances with more energy efficient devices offers substantial conservation potential immediately. For example, in 1986 the Commonwealth retained an energy service company to improve the efficiency of two of its large downtown Boston office buildings, the McCormack and Saltonstall, whose combined energy bill was three million dollars per year. As a result of installing equipment such as timers on lighting, and changing maintenance procedures, the energy bill for the two buildings has been reduced by over $840,000 per year. Similar energy efficiency improvements in office buildings throughout Massachusetts could save substantial amounts of energy.

New buildings, industries and equipment offer some of the best opportunities for cost-effective energy efficiency investments. It is far less expensive to design an energy-efficient building than to retrofit an inefficient one. It is important that efficiency for new uses be promoted now because cost-effective opportunities may be lost forever if inefficient new uses are allowed to be installed. Opportunities for energy efficiency in new uses will always be available, and will be greatest at the time of greatest need -- when growth in new uses, and consequently customer demand, are high. In addition, new technologies for improving energy efficiency are constantly being developed, further ensuring that cost-effective conservation opportunities will exist well into the future for both retrofit and new energy uses.

3. The Utilities' Role

Utilities should fully consider energy efficiency options in their planning for new power supplies. Energy efficiency and conservation programs should be evaluated side-by-side with both utility and non-utility generating options. Utilities should pursue through direct investment those programs which rank highest in such an evaluation. Direct investment efforts for energy efficiency should be comparable to the commitment utilities have historically demonstrated to power plants.

The direct investment approach to utility energy efficiency programs is necessary because customers are unlikely to develop the full potential for cost-effective conservation on their own. Market imperfections result in investments by individual customers acting alone which, taken together, are less than optimal from the utilities' or society's point of view. Direct investment, packaged and marketed properly, provides a means for utilities to overcome these obstacles.

4. The Commonwealth's Role

The Commonwealth must act to provide utilities with the appropriate policy and regulatory incentives for cost-effective direct investment in energy efficiency. Adoption of a formal least-cost integrated planning process should provide the necessary framework. In addition, the Commonwealth should continue to adopt energy efficiency standards, codes and regulations, mechanisms that are not available to utilities. Massachusetts has already implemented appliance efficiency standards and upgraded the energy portions

of the residential and commercial building codes. In the coming years, EOER will pursue additional efforts along these lines.

5. Summary

The challenge facing Massachusetts today is to take full advantage of all available cost-effective energy efficiency opportunities. Utilities should adopt aggressive direct investment approaches to developing conservation opportunities, while the Commonwealth should continue to promote and enforce appropriate energy efficiency standards, codes and regulations, in addition to providing a supportive regulatory environment for utility direct investment efforts.

C. NATURAL GAS

1. Recommendation for Action

> Additional pipeline capacity to deliver at least 300 to 400 million cubic feet a day of incremental natural gas supplies to Massachusetts should be built by the early 1990s in order to meet the growing needs of traditional gas customers as well as new electric generation loads. The construction of such new capacity would enhance the Commonwealth's fuel diversity and reliability, provide substantial environmental benefits, enhance inter- and intra-fuel competition and provide an efficient and economic fuel supply source, particularly for power generation.

Massachusetts needs new gas pipeline capacity because existing capacity is fully utilized in the peak winter heating season and substantial new demand is expected over the next decade. In the absence of major additions to pipeline capacity, much of this potential demand may be served instead by other fuels, with the likely result being a less secure,

more expensive and less environmentally desirable fuel mix. Currently, a number of proposals to expand pipeline capacity to Massachusetts and elsewhere in the Northeast are being considered by the Federal Energy Regulatory Commission (FERC) in its "open season" proceeding.

2. Advantages of Increasing Natural Gas Use

Massachusetts would realize a number of benefits from the increased availability of new natural gas supplies, including:

- o **Fuel Diversity.** Additional gas supplies would increase the diversity of Massachusetts' fuel mix. With its natural gas market share continuing to lag behind the United States', Massachusetts remains overly dependent on imported oil to meet its energy supply needs.
- o **Reliability.** Natural gas is a highly reliable fuel supply. Existing supplies are abundant, substantial new supplies are readily available to meet long-term needs, and the delivery of these supplies is not subject to disruption by unreliable suppliers.
- o **Environmental Benefits.** Gas is the cleanest burning and most environmentally benign fossil fuel. With its increased availability, certain existing power plants can switch to gas, and new cogeneration, small and independent power facilities may use it, resulting in the emission of fewer harmful air pollutants than

if other fuels were used.

- o **Efficient and Economic Supply Source.** Gas would be an efficient and economic fuel supply source, particularly for power generation. Power plant technologies which use gas are relatively efficient and the cost of natural gas compares favorably with other fuels.
- o **Increased Competition.** The addition of a new gas pipeline would increase competition locally for the transportation and sale of gas and would place downward pressure on the cost of gas from existing suppliers, thereby benefiting consumers.

3. Prospects for Additional Gas Supplies

In response to a growing interest in the market potential for gas in the Northeast, FERC established an "open season" in July 1987 to invite new proposals to expand gas pipeline capacity into the region and eliminate obsolete proposals. FERC received approximately thirty-five applications by the filing deadline of January 15, 1988. A number of these applications proposed to expand pipeline capacity into Massachusetts.

To date, FERC has designated several projects proposing to serve Massachusetts as "discrete" and therefore able to receive expedited approval. Together they will provide incremental pipeline capacity of about 200 million cubic feet per day to the Commonwealth and are expected to be approved and operating by 1989 or 1990.

The remaining projects, which include the bulk of the new gas supplies proposed for Massachusetts, have been the focus of settlement discussions during the summer and fall of 1988. As of November 1988, no consensus had emerged in support of a single proposal. EOER, along with the Energy Facilities Siting Council and the Department of Public Utilities, has been playing an active role to encourage the settlement discussions. The Commonwealth favors a settlement approach as the best, and perhaps only, means of meeting the urgent needs of Northeast customers for additional pipeline supplies in a timely manner. If a broadly accepted settlement is not achieved, lengthy comparative hearings may be required to determine which projects go forward.

4. Strategies for Meeting Expected Gas Demand

The bulk of the gas requested by Massachusetts firms in the open season is required to fuel new power plants in the early 1990s. If settlement negotiations fail, it is unlikely that Massachusetts will obtain its needed pipeline supplies until the mid-1990s. For many proposed cogeneration, small and independent power facilities, the inability to secure firm pipeline gas by a certain date may lead to project cancellation. Some facilities may be able to use interruptible gas supplies and burn oil when pipeline gas is unavailable. However, air quality and operational considerations may limit their ability to burn oil. Therefore, if substantial new pipeline capacity cannot be made available in a timely manner, it will be incumbent upon utilities to place a greater emphasis on conservation of both electricity and gas. Even with

aggressive conservation efforts, however, substantial additions to existing pipeline capacity will be needed to meet Massachusetts' future energy needs.

5. Summary

There is a large potential market for natural gas in Massachusetts that can be served only if additional pipeline capacity of about 300 to 400 million cubic feet per day is sited and built by the early 1990s. EOER believes that settlement in FERC's "open season" proceeding offers the best hope for the delivery of significant new volumes of pipeline gas to Massachusetts within this timeframe. Supplemental gas and expanded conservation efforts have important roles to play, but it is clear that substantial additions to pipeline capacity are desirable and would benefit Massachusetts' energy consumers.

D. COGENERATION, SMALL AND INDEPENDENT POWER

1. Recommendation for Action

> The Commonwealth should encourage the development of those cogeneration, small and independent power projects which have social and environmental benefits in addition to supplying economic electricity for utility ratepayers. Such projects would utilize existing commercial and industrial sites; improve the competitiveness of Massachusetts' business and industry; and minimize environmental impacts.

EOER recognizes that a wide range of facilities not owned by utilities will have an important role in contributing to Massachusetts' portfolio of electricity supply options. The benefits of the development of those cogeneration, small and independent power projects which directly improve the competitveness of Massachusetts businesses and generate

electricity with minimal environmental impact should be recognized over those projects which do not.

2. The Current Situation

Under the Massachusetts regulations implementing the federal Public Utility Regulatory Policies Act of 1978, retail electric utilities are required to solicit bids for cogeneration and small power generating capacity (so-called "qualifying facilities"). At least once a year, in an innovative competitive bidding process, utilities select among competing projects desiring to sell their power. Utilities may consider price and other project characteristics, such as size, fuel type and site ownership, when evaluating bids to determine from which projects to buy electricity on a long-term basis. Utilities are not required by law or regulation to purchase power from independent power producers, e.g., natural gas-fired units not owned by a utility.

The number of projects offered in response to recent utility requests for proposals has been impressive. Boston Edison Company received bids for 1,848 megawatts when it sought 200 megawatts of capacity; Eastern Edison Company received bids for almost 180 megawatts when it sought 30 megawatts; and Commonwealth and Canal Electric Companies received proposals for 900 megawatts when they sought 109. In the largest response to date, New England Power Company received bids representing 4,780 megawatts to fill 200 megawatts of projected need. To adequately assess the relative benefits of, and to efficiently select among, a diverse and rapidly expanding group of cogeneration, small and

independent power projects, the Commonwealth needs to refine the implementation of its competitive bidding policy in a manner consistent with a least-cost integrated planning process.

3. EOER Initiatives

EOER has undertaken several initiatives, consistent with the implementation of a formal least-cost integrated planning process, which it believes will facilitate the identification, selection and development of those cogeneration, small and independent power projects which offer social and environmental benefits in addition to supplying economic electricity for utility ratepayers.

First, EOER is working to improve the consideration of these benefits in the existing cogeneration and small power project evaluation system to give credit to projects at existing commercial and industrial sites; to encourage fuel diversity; and to promote the use of renewable energy resources. Cogeneration projects at existing sites have several advantages which new, stand-alone projects do not. They can reduce the costs of doing business for the industries they serve, they have a greater likelihood of actually being completed, and they can provide environmental benefits to the extent that older, "dirtier" boilers are replaced by cleaner ones. Projects which use fuels such as natural gas and coal, which have been underutilized in Massachusetts, contribute to fuel diversity. Utilities should recognize these benefits in their evaluation of projects under the competitive bidding system. Lastly, projects which use renewable fuels should not

only be given credit for their negligible environmental impacts and use of indigenous resources, but should be given financial incentives to encourage their development and secure the social and environmental benefits they confer.

Second, EOER is working with the Department of Environmental Quality Engineering to improve the existing environmental permitting process not only for cogenerators, small and independent power producers, but also for utility-owned generation.

Third, EOER is working to minimize missed opportunities for cogeneration and small power development in Massachusetts. EOER is evaluating the desirability of increasing the size limit (which now stands at one megawatt) for projects which can sell their power to utilities without participating in the competitive bidding process. The costs of participation may be too high for some very small but beneficial projects.

EOER also believes that, in some circumstances, it would be beneficial for cogeneration, small and independent power facilities to make retail sales of their power either on-site or to a limited number of customers, in addition to local utilities. Under current law, sales of this type are effectively prohibited. EOER supports allowing limited retail sales as a way to realize fully the benefits offered by these projects. EOER recognizes concerns that have been raised by the utilities about limited retail sales. EOER agrees that such sales should be limited so that utilities would not lose significant numbers of customers, and that utilities should be

able to charge a fair price for reconnection or backup power that they may be obliged to provide.

4. Summary

EOER is promoting several specific initiatives to achieve the goal of encouraging those cogeneration, small and independent power projects with social and environmental benefits in addition to supplying economic electricity for utility ratepayers. These initiatives will also ensure that the utilities' evaluation and selection of cogeneration, small and independent power projects as resource options will be consistent with least-cost integrated planning principles. In addition, they will help to remove unnecessary barriers to the development of these projects.

E. NEW ELECTRIC UTILITY GENERATION

1. Recommendations for Action

New utility generation projects, including power plant sites and technologies, should be identified and proposed now by the Massachusetts utilities where they will improve the reliability, diversity and flexibility of the utility system; minimize the environmental impacts of electricity generation; and provide insurance against uncertainties with respect to the adequacy of electricity supplies. The criteria used to select projects should be consistent with the principles of least-cost integrated planning. To facilitate the timely selection of projects, EOER supports the implementation of regulations which provide for a coordinated pre-siting and pre-approval process for new electric utility generation.

New electric utility generation -- including power plants, major transmission facilities, and life extension work or "repowering" at existing power plants -- is yet another option in the utilities' resource portfolio. While it has not

received as much attention in recent years as some other options (e.g., energy efficiency and non-utility generation), new utility generation has characteristics that may make it particularly appropriate for meeting utilities' electricity supply needs in some situations. These characteristics may not be unique to utility generation, but utilities may be uniquely positioned to pursue certain projects with them: power plants on utility-owned sites, regional transmission interconnections, or projects which are needed but which other entities are unlikely or unable to develop. The task for utilities, energy policymakers and regulators is to identify the right plant at the right time and place.

2. The Role of New Utility Generation

EOER recognizes that new utility generation has a place in utilities' supply plans. Massachusetts' utilities should pursue those projects which will offer reliability, diversity and flexibility benefits to the system; minimize the environmental impacts of electricity generation; and provide insurance against uncertainties with respect to the adequacy of electricity supplies.

- **Reliability.** New utility power plants can enhance the reliability of the transmission grid serving Massachusetts. Electric generators provide not only "real power", or what is commonly referred to as electricity, to meet the demands of customers, but also what is called "reactive power" which is necessary to maintain the voltage levels and stability of

the transmission grid. In the right location, new power plants can enhance the stability of the grid. In areas like eastern Massachusetts, with growing demand and unreliable generation, properly sited new utility power plants may be part of the solution (along with better plant maintenance, new capacitors and new non-utility generation) to the occasional system reliability problems that have begun to occur.

- **Diversity and Flexibility.** New utility generation can also add to the diversity and flexibility of Massachusetts' utility system. The increased use of natural gas, clean coal, and renewable technologies in both utility and non-utility generation will add to Massachusetts' fuel diversity. Utilities, however, may be in the best position to investigate the potential of some emerging technologies, such as advanced clean coal and photovoltaics, and to realize the diversity benefits they can offer. New, renewable or cleaner burning and more efficient dual fuel plants can also add to utilities' flexibility if the operation of older, "dirtier" plants is limited by new environmental requirements, such as measures to reduce acid emissions.
- **Meeting Environmental Requirements.** New utility generation should also be considered to

meet new environmental requirements. These new requirements may potentially limit the operations of existing power plants. While energy efficiency and non-utility generation can make up for the loss of some existing utility generating capacity, utilities should be exploring new power plant technologies, including coal gasification and photovoltaics, and identifying potential sites now to replace existing "dirty", hazardous or inefficient power plants. New power plants, in conjunction with additional transmission projects, non-utility generation and aggressive energy efficiency programs, may prove to be the utilities' most effective and economic option for ensuring adequate future electricity supplies.

- o **Forecasting and Supply Resource Risk.** Utilities face many uncertainties with respect to demand forecasting and supply planning. Plans for new utility generation may be part of the utilities' "insurance" policy to guard against the possibility that electricity supplies will not be adequate to meet demand. Plans for new transmission facilities or the repowering or life extension of existing plants may be especially appropriate because of the flexibility they offer, and their generally

shorter lead-times and lower costs.

3. Pre-approval and Least-Cost Integrated Planning

A coherent least-cost integrated planning process, with pre-approval of utility resource plans, can help the utilities to realize the reliability, diversity, flexibility, environmental, and insurance benefits that new utility generation can offer. EOER supports the adoption of a pre-siting and pre-approval process for new utility generation within the context of a formal least-cost integrated planning framework. A pre-approval process would provide Massachusetts' utilities with the direction they are seeking from policymakers and regulators. Within a least-cost integrated planning framework, it would facilitate the utilities' selection of the appropriate next power plant.

4. Utility Plans for New Generation

Several utilities are currently including preliminary or firm proposals for new generation in their long-range supply plans. These include: a new power plant at Boston Edison's Edgar Station in Weymouth, Massachusetts; repowering of New England Power Company's Manchester Street station in Providence, Rhode Island; another power purchase from Hydro Quebec via Central Maine Power Company; a power purchase involving construction of transmission facilities from Nova Scotia to Plymouth, Massachusetts; and a possible power purchase over existing transmission lines from New Brunswick.

5. Summary

New utility generation has a role to play in

Massachusetts' future electricity supply mix. Electric utilities should be identifying and selecting power plant sites and technologies now to improve the reliability, diversity and flexibility of the utility system; to minimize the environmental impacts of electricity generation; and to provide insurance against uncertainties with respect to the adequacy of electricity supplies. The benefits that new utility generation can provide would be recognized with the implementation of a formal least-cost integrated planning process in Massachusetts. The utilities should then be able to identify, select, gain approval of and develop appropriate generation projects.

III. CONCLUSION

The energy debate in Massachusetts has focused until recently on the questions of whether Massachusetts needs additional energy and electricity supplies and whether there are resource options which could meet this need. The growing consensus is that the answers to these two questions are yes. Now the imperative is to move on to the still unanswered questions: how can energy suppliers, policymakers and regulators identify those options which should be developed first, and what actions should be taken to facilitate their development? This report has addressed these latter two questions.

EOER has laid out a course of action for five "critical path" energy policy areas: least-cost integrated planning;

energy efficiency; natural gas; cogeneration, small and independent power; and new utility generation. Adoption of a formal least-cost integrated planning process by policymakers and regulators and its full implementation by the electric utility industry will answer the question of which energy supply resources to develop first. With a least-cost integrated planning framework in place, utilities, policymakers and regulators can then focus on the second remaining question: what are the actions necessary to make these resources a reality? This report, **Developing Energy Resources: A Five Point Plan**, has discussed the actions with which EOER would begin. It is EOER's initial response to the two still open questions. However, EOER believes that if its recommendations for action are followed, the Commonwealth's citizens will enjoy a safe, secure, and economical energy future.

CHAPTER I

INTRODUCTION

OVERALL OBJECTIVE

The Executive Office of Energy Resources (EOER) is the cabinet level agency of the Commonwealth responsible for developing, coordinating and promoting a comprehensive energy policy for Massachusetts. EOER's primary objective is to develop and implement policies and programs which encourage the energy industry to provide adequate energy supplies and services to meet the Commonwealth's needs and sustain economic growth. Energy supplies must be adequate not only to meet expected needs but also to cover contingency events, such as higher than expected energy demand or the loss of an energy supply source. Cost must also be considered. The energy needs of Massachusetts' citizens, businesses and industries must be met at a reasonable cost. At the same time, environmental impacts must be taken into account. Energy supplies must be developed or acquired in a manner that is consistent with Massachusetts' environmental policies and goals.

THE CURRENT SITUATION

The adequacy, reliability, cost, safety and environmental consequences of Massachusetts' and New England's energy supplies have received a great deal of attention in the last few years. Various groups of energy users have commented on the ability of existing and planned energy supplies to meet current and future needs. These include industry, business and residential consumers, as well as utilities, other energy suppliers, government policymakers and regulators, and others with an interest in energy and environmental issues. Electricity is the energy resource which has been most

discussed, although oil and natural gas have also been examined. Several groups -- business, governmental, and environmental -- have released reports outlining their views of Massachusetts' and New England's energy situation. Two have been at the center of the debate.

The first, released by the New England Governors' Conference, Inc. (NEGC) in December 1986, focused on electricity. Entitled "A Plan for Meeting New England's Electricity Needs", it was prepared by the energy directors and public utilities commission chairs of the six New England states, with assistance from the New England Power Pool representing the region's electric utilities. The report assessed New England's electricity supply situation under base and contingency scenarios, and concluded that supplies would be tight for the near future, but could be adequate for the long-term if a series of actions were taken immediately by the utilities and state policymakers and regulators. Work began in January 1987 on implementation of the report's recommendations.

A second report, "Planning for New England's Electricity Requirements", was released by the Federal Reserve Bank of Boston in late 1987. Prepared in response to concerns raised by the business community, it focused on the same issue as the New England Governors' report -- the adequacy of future electricity supplies. While it concluded that new electricity supplies would not be needed until the mid-1990s, it expressed doubt about the utilities' projections, especially for the near-term, of demand, conservation, cogeneration, and small and independent power development. It concluded that there were

factors in the utility industry environment that made it uncertain whether the utilities would achieve their goals, and consequently whether electricity supplies would be adequate.

While these and other reports have focused on electricity, other energy resources, most notably natural gas and oil, have also been given consideration. Concerns have been raised about indications of a growing dependence on imported oil and the impact that this would have on the stability and cost of oil supplies for all consumers. Questions have also been raised about the availability of additional natural gas supplies for New England. Projections of electricity supply and future natural gas consumption in several recent reports were based on the assumption that additional natural gas supplies would be available to New England within a certain time period. Realization of that timetable still faces potential obstacles.

EOER has been extensively involved in the debate over Massachusetts' energy supplies, and has taken action to promote the development of additional energy supplies for Massachusetts and New England. Much of this action has taken place in the Massachusetts regulatory arena. EOER has promoted change in the Department of Public Utilities' treatment of utility investments in new power plants and other supplies. EOER also participated in a proceeding investigating the adequacy of utility planning for the summer of 1987. Most recently, EOER has helped to advance a proceeding on "least-cost integrated planning" (a term used to refer to comprehensive utility planning for new supplies) which should clarify and streamline

electric utility regulation in Massachusetts. EOER has also been involved in the federal proceeding to bring new natural gas supplies to the Northeast. However, indications of continuing high growth in the demand for energy by Massachusetts' consumers require that more be done and current actions be accelerated to develop additional energy supplies and services.

GOAL OF THIS REPORT

The goal of this report is to provide a clear statement of how EOER believes energy suppliers should select and efficiently develop new energy supplies. Most recent reports recognize that there are a number of supply options which Massachusetts' and New England's utilities could pursue, among them conservation, cogeneration and small power, independent power, new utility generation. However, there has been little consensus on how utilities and other energy suppliers should choose among the various options.

This report presents a course of action to be followed by Massachusetts in five key energy policy areas:

1) least-cost integrated planning;

2) energy efficiency;

3) natural gas;

4) cogeneration, small and independent power; and

5) new electric utility generation.

EOER believes these five policy areas are on the "critical path" for achieving the overall objective of adequate energy supplies.

Action must begin with the elaboration and

implementation of a formal least-cost integrated planning framework for Massachusetts' utilities. In addition, EOER believes action must be taken now to facilitate the development of energy efficiency, cogeneration, small and independent power, and new electric utility generation. The development of these latter two options will depend in part on the availability of additional natural gas pipeline capacity. Action must be taken to facilitate this as well. The next chapter discusses recommendations for action in the five major energy policy areas identified above.

CHAPTER II

RECOMMENDATIONS FOR ACTION: A FIVE POINT PLAN

Least-Cost Integrated Planning

A. LEAST-COST INTEGRATED PLANNING

1. Recommendation for Action

A formal least-cost integrated planning process should be adopted by policymakers and regulators and implemented by the electric utility industry. This is necessary to identify and develop new power supply resources and new opportunities for using electricity efficiently and economically. Adoption and implementation of a least-cost integrated planning process -- through selection, approval and development of the energy resource options identified -- would ensure that Massachusetts' energy supplies would be adequate to meet current and future needs, given a range of contingencies, at a reasonable cost and with minimal environmental impact.

2. The Task for Least-Cost Integrated Planning

"Least-cost integrated planning" refers to a comprehensive planning process used for evaluating and setting priorities for development of new energy supply options. The focus here is on least-cost integrated planning in the electric industry. However, the principles involved can also be applied to the natural gas industry as well as other segments of the energy industry, and eventually should be, to ensure a future of balanced, "least-cost" energy supplies for Massachusetts.

Least-cost integrated planning offers utilities, energy planners, policymakers, regulators, the business community and other energy consumers a way to sort through the variety of potential electricity resource options: "demand-side" options such as conservation, load management and energy efficiency; "non-utility" options such as cogeneration, small and independent power; and new utility options such as new power plants, "repowering" and life extension of old plants, construction of major transmission lines and facilities, and power purchases from other utilities. While the

characteristics, costs and benefits of each of these options can to some degree be evaluated individually, they must be systematically assessed side-by-side to determine the best resource mix and the order in which they should be developed. Adoption of a formal least-cost integrated planning process would provide the needed framework for just such an assessment.

In a comprehensive least-cost integrated planning process, the available electricity supply options can be systematically evaluated against criteria that have been generally recognized as important:

- o Feasibility and Adequacy. Is it feasible to develop or ensure the availability of a particular resource by the time it will be needed? This will determine its adequacy, or ability to meet electricity supply needs.
- o **Reliability.** Is the resource reliable? How likely is it to be available when need is greatest? Does it have particular characteristics that make it particularly appropriate for some needs?
- o **Diversity and Flexibility.** Does the resource add to the diversity of the utility system? Can it use more than one fuel? Does it use a fuel now underrepresented in the fuel mix? Is it flexible? Can it be brought on-line quickly or delayed easily if circumstances so require?
- o **Cost.** What will the option cost, including direct, financing and administrative costs? What

are the separate costs, if any, to the utility, the developer and the customer?

- o Environmental, Economic and Social Impacts. What will be the effect of a resource option on the surrounding environment (air, land, water); on the local economy (jobs, secondary economic activity); and the community (the attractiveness of a locale as a place to live)?

The task for utilities, policymakers and regulators is to evaluate electricity supply options against all of these criteria simultaneously and to pursue the development of those which, overall, best meet the needs of both energy suppliers -- utilities and independent developers -- and energy consumers -- the business community, industry and the residential sector. This is the task that has not yet been accomplished.

The energy debate until recently has focused on two questions: whether Massachusetts needs additional energy and electricity supplies, and whether there are supply options which could meet this need? A degree of consensus has been reached that the answers to these two questions are yes. Now, it is both timely and necessary to move the focus of the discussion onto the next two questions: how should utilities and other suppliers identify those resources which should be developed first, and what actions should be taken to facilitate their development?

3. The Specific Issues: A Brief Recapitulation

a. Background

The first issue that has been raised in the ongoing

energy debate in Massachusetts is what are the electricity supply options available to meet the Commonwealth's current and projected needs. A variety of electricity resource options exist that go beyond what were traditionally considered. Where electric utilities once met growing customer demand by building power plants one after another, today their view of supply options has broadened. This change in perspective was driven by the circumstances of the 1970s: the oil crises of 1973 and 1979 which drove energy and electricity prices up dramatically; utilities exhausting the "economies of scale" in power plant construction (with the advent of large-scale facilities of 1000 megawatts or more) thereby further increasing electricity costs; general economic trends which increased utilities' financing and construction costs; and the adoption of needed environmental and safety regulations as the impacts of certain power plant technologies became more clearly understood.

These increases in energy costs caused consumers to conserve or invest in energy efficiency. At the business and industry level, conservation and energy efficiency investment were driven by the need to reduce production costs in order to remain competitive. At the residential level, they were driven by household budget constraints. Faced with reduced growth in demand for their product, utilities had to rethink their own supply and marketing strategies to remain competitive.

Another change in the energy environment has been the emergence of non-utility electricity suppliers. Federal laws passed in the late 1970s to encourage oil conservation and renewable resource development helped to create a market for

electricity produced by cogenerators and small power producers. More recently, larger independent power producers have emerged to fill another niche in the electricity supply market.

Lastly, utilities have begun to expand their own generation options. Their focus has shifted from traditional, large power plants of over 1,000 megawatts to more modular, flexible designs in the 150 to 300 megawatt range. Utilities have also begun to build major transmission lines as a way to tap additional electricity supplies, and to explore the "repowering" or "life extension" of existing power plants.

b. The Feasibility of Energy Efficiency; Cogeneration, Small and Independent Power; and New Utility Generation

The second major issue is whether it is feasible, cost-effective and safe to develop these options and to what extent it is desirable to develop each. While there has been general agreement that a variety of supply options exist, a consensus has not developed on how much power each option could provide and in what time period.

Theoretically, for example, one could replace every commercial heating, ventilating and air conditioning (HVAC) system in Massachusetts with the most efficient commercially available technology today; however, such a massive retrofit program may not be feasible in the timeframe required. Likewise, the utilities could theoretically build dozens of small, 80-megawatt gas turbine power plants across the state; the technology is well-developed and largely "off the shelf". However, finding sites for dozens of small new plants would be

quite difficult; building pipeline connections to each of them would be costly; and their environmental impacts would be significant in the aggregate. Therefore, options which are technically possible may not be feasible or desirable.

c. Selecting the Desirable Mix of Options: Where Least-Cost Integrated Planning Comes In

The challenge is to select from among the options available those which best meet the criteria of adequacy (feasibility); reliability; diversity; flexibility; cost; and environmental, economic and social impacts. The hard part of determining the desirable mix of options is finding a way to compare the costs and benefits of very different resources. It is relatively easy to compare the performance of options along the lines of a single criteria: the price of one option with the price of another, the environmental impacts of one with the environmental impacts of another.

However, it is much more difficult to compare options across criteria: the price of one against the environmental impact of another, the economic effects of one against the reliability of another. For example, how should one compare a new coal-fired plant with low fuel costs, secure fuel supplies, but significant air quality impacts versus a large photovoltaic generating station with much higher capital costs but no fuel costs, no air emissions and no ash disposal costs? Moreover, if agreement on a desirable mix of options can be reached at one point in time, how can utilities, and others most affected by such decisions -- the business community, industry and residential consumers -- be assured

that this mix will continue to be regarded as the most desirable, or at least reasonably good, over time?

EOER has submitted proposed regulations to the Department of Public Utilities to create a uniform least-cost integrated planning framework for electric utilities. The proposal includes a means for selecting a mix of supply options for development now and for ensuring that this mix will prove acceptable over time.

4. EOER's Proposal for Least-Cost Integrated Planning

The least-cost integrated planning regulations proposed by EOER require utilities to identify which supply options are feasible; establish what the criteria are for evaluating them; provide a means for determining what mix of options will best meet these criteria; and address the issue of regulatory uncertainty. EOER's proposal calls for a coordinated review every two years of utilities' electricity supply plans by the Energy Facilities Siting Council and the Department of Public Utilities.

Participation by state energy policymakers and representatives of all those who would be affected by the utilities' plans -- the business community, industry, environmental groups, and consumers -- would be encouraged. The review of utility resource plans in such a public forum would help to create greater consensus on the resolution of Massachusetts' ongoing energy debate, and more important, consensus on how Massachusetts' utilities, with guidance from policymakers and regulators, will meet the energy needs of the Commonwealth's businesses, industries and citizens. Utilities

would benefit from receiving regulatory approval of supply plans every two years, with assurances of cost recovery for expenditures on approved resource options. In this way, regulatory uncertainty would be greatly reduced.

Specifically, EOER's least-cost integrated planning proposal:

(1) provides a method for the development of a consensus on which criteria are most important and should be used to evaluate the variety of supply options available;

(2) recognizes that there are many resources best developed by the utilities -- some on the "demand-side" (e.g., certain energy efficiency investments) and some on the more traditional "supply-side" (e.g., certain power plants and transmission investments) -- and that utilities must continue to be responsible for identifying and developing them;

(3) integrates the Massachusetts competitive bidding process for cogeneration and small power into a broader competitive bidding process for all types of power resources;

(4) recognizes that to be effective, least-cost integrated planning requires periodic regulatory review to give the utilities ongoing approval for their resource plans and to develop and maintain public consensus on the appropriateness of these plans and the actions necessary to implement them; and

(5) acknowledges the need to provide utilities with adequate, fair and equivalent incentives for expenditures on and commitment to all types of options, particularly demand-side resources, to ensure that utilities are not biased toward or away from any one type of resource.

Least-cost integrated planning rules similar to those proposed by EOER have been adopted in several other states and by the Northwest Power Planning Council. For example, Wisconsin has had a least-cost planning process for its electric companies for ten years and is about to complete its fifth two-year cycle. Other states with formal least-cost integrated planning processes include Nevada, Texas, Illinois, California, Maine, plus the District of Columbia.

EOER's proposed rules were being considered by the Department of Public Utilities as this document went to press. EOER is seeking closure on this rulemaking by the second quarter of 1989.

5. Summary

In this section, EOER has presented its view of the role that formal least-cost integrated planning can play in answering the question of how to identify those energy supply options which should be developed first. The remaining four sections of this chapter discuss what actions should be taken to facilitate their development to ensure that Massachusetts' energy supplies will be adequate to meet current and future needs, given a range of contingencies, at a reasonable cost and in a manner consistent with environmental policies.

The recommendations for action suggest ways to facilitate development of attractive energy resources for Massachusetts. Each resource should be pursued to the extent that it is part of a least-cost energy mix. EOER is confident that each of the four resources discussed below will play an important part in powering Massachusetts' future. Adoption of

a least-cost planning framework will serve to guide the utilities and other energy suppliers in determining how much of which resources should ultimately be developed.

Energy Efficiency

B. ENERGY EFFICIENCY

1. Recommendation for Action

Successfully developing all cost-effective energy efficiency will require aggressive action and comprehensive direct investment by Massachusetts' electric and gas utilities. The Commonwealth should promote a policy and regulatory framework which provides fair and adequate incentives to utilities for such action and investment. In addition, the Commonwealth should continue to adopt and promote all appropriate energy efficiency standards, codes and regulations. These efforts must be undertaken immediately to ensure that energy efficiency opportunities are not lost and that this important resource is developed to help meet both short- and long-term energy needs.

Efficiency improvements are equivalent to providing energy from power plants -- each kilowatt or kilowatthour conserved means that one less needs to be generated. Energy efficiency, however, offers additional benefits over power plants: it is relatively inexpensive; environmentally clean; highly reliable; contributes to Massachusetts' economic competitiveness by reducing energy costs to business and industry; and creates local employment and investment opportunities. Among all energy resource options, efficiency offers utilities the greatest potential for satisfying future power supply requirements at a reasonable cost and with minimal environmental and social impacts. Electric and gas utilities can tap this resource through programs which provide information, energy-efficient equipment, financial incentives, and technical assistance to encourage customers to make efficiency improvements.

2. The Role of Energy Efficiency in the Commonwealth

a. What Is Energy Efficiency?

Energy efficiency is achieved by reducing the amount

of electricity, gas, or oil needed to provide heat, light, motor drive, and the other "energy services" customers desire. By installing efficiency measures such as insulation, high-efficiency lighting and motors, energy service levels can be maintained or improved while reducing energy consumption. As a result, conservation can reduce customers' energy consumption and may lower their bills without requiring any lifestyle sacrifice from them.

The experience of the past fifteen years has shown that energy efficiency works. Since the oil price shocks of 1973, the United States economy has expanded by over 35 percent (in terms of Gross National Product) while total energy use (in BTUs) has remained constant. While electricity consumption has deviated from this trend as a result of the increasing electrification of many end-uses, efficiency has improved there as well. This extraordinary increase in efficiency has resulted from the combined effect of many homeowners weatherizing their houses, businesses finding ways to operate more efficiently, industries developing more efficient processes for manufacturing their products, and higher efficiency levels in new buildings and appliances. No other energy "resource" has so dramatically improved the national energy situation during this period.

A flood of developments in technologies, materials, and designs related to energy use have made these efficiency improvements possible. Some of these developments include:

- New lighting systems, i.e., bulbs, ballasts, reflectors, and better use of natural light,

which reduce electricity consumption by 50 to 80 percent. Lighting savings of over 75 percent have frequently been demonstrated in commercial buildings.

- **Insulation and other measures** which reduce energy consumption in residential and commercial buildings. Recently built "super-efficient" homes in Minnesota use 68 percent less energy than average United States homes, and some units in Sweden use 89 percent less energy than the United States average. Since 1973, energy consumption in new United States office buildings has been cut nearly in half.
- **High-efficiency refrigerators and other appliances** which require substantially less electricity than inefficient designs. The average new refrigerator consumes 27 percent less electricity than the average existing refrigerator in the United States, and the best model on the market consumes 50 percent less. Further advances are expected: a Danish prototype model consumes 65 percent less, and a California custom model 84 percent less.
- **High-efficiency motors**, computerized motor controls, and more efficient industrial processes which reduce industrial electricity needs while maintaining or increasing levels of output. The average Japanese paper plant or

steel mill is 30 to 50 percent more efficient than it was ten years ago due to process and equipment advances.

Utilities also have opportunities for improving the efficiency of their own operating systems. "Load management" can be used to control the pattern of customer demand for electricity or gas, in order to reduce utility fuel and operating costs. Customer demand for electricity or gas varies throughout each day and week of the year, creating "peak" loads which are substantially greater than "off-peak" loads, and more expensive for utilities to meet. For example, air conditioners in commercial buildings create peak loads in the middle of a hot summer business day. To meet this peak demand, electric utilities must run their more expensive power plants, generally those with higher fuel costs.

Similarly, during the peak winter heating season, gas utilities rely on more expensive liquefied natural gas (LNG) or propane in addition to pipeline gas to meet customer demand. Electric and gas companies and their customers can save significantly on fuel expenses by reducing peak loads, or shifting peak loads to off-peak periods. In addition, since new power plants and gas storage facilities must be built to meet peak loads, load management can often delay or avoid the need for them.

Utilities can achieve load management by offering customers financial incentives to reduce demand during peak periods or to shift demand from peak to off-peak periods. For example, utilities may adopt time-of-use rates, where they

charge customers for electricity based on the actual costs of production at the time of use, with lower rates during off-peak and higher rates during peak periods. An industrial customer might shift electricity-intensive processes to off-peak periods -- the evening or early morning -- to take advantage of time-of-use rates. Utilities gain from lower fuel costs and greater operational flexibility now, and in the long run, from possibly reduced power supply requirements. Customers gain from lower bills.

b. Advantages of Energy Efficiency

The primary advantage of energy efficiency improvements is their very low cost relative to other power supply options. For example, energy efficiency programs developed by the Northwest Power Planning Council are expected to save 3,691 megawatts by the year 2005 at an average cost of two cents per kilowatthour. This compares favorably to the roughly five cents per kilowatthour for energy from a coal plant there which would be needed to generate electricity in the absence of efficiency gains. This cost advantage over other power supplies means that energy efficiency improvements should be developed based on their economic merits alone. In addition, efficiency improvements offer a host of other advantages to the utility, its customers, and society in general, including:

- Planning Flexibility. Most efficiency improvements can significantly increase utility planning flexibility, because they can be installed in small increments, with short lead

times, and with lower financing requirements. In addition, energy efficiency is not subject to the risk of fuel price increases. Furthermore, energy efficiency lowers load growth, thereby reducing one of the greatest sources of uncertainty for utility planners.

- **Low Environmental Impact.** Most energy efficiency improvements have no environmental impacts. This is in stark contrast to existing or new power plants which contribute to air pollution, generate liquid, solid, or radioactive wastes, pose land use and water use problems, and have visual impacts. Traditional oil and coal plants are major contributors to acid rain and the "greenhouse effect", yet Massachusetts relies on these fuels for over 60 percent of its electricity.
- **Economic Benefits.** Energy efficiency can improve the general economy by reducing the energy costs of doing business. Money not wasted on energy bills can be invested toward more productive ends. Japan and West Germany use roughly half as much energy per unit of economic output as the United States. Massachusetts' businesses will be at a competitive disadvantage if their investment capital continues to be spent on inefficient energy practices.

- o **Utilization of Indigenous Resources.** Efficiency improvements do not rely on imported fuels, and are developed using local labor and capital.
- o **Job Creation.** Energy efficiency efforts can create stable local jobs for architects, engineers, installation contractors, equipment manufacturers and distributors, and others. A recent study commissioned by the Bonneville Power Administration concluded that efficiency improvements could result in up to four times as many sustainable, high-quality jobs than the alternative of power plant construction. This is because efficiency improvements tend to be more labor-intensive and are less dependent on labor imported from other regions.

c. Opportunities for Energy Efficiency

Cost-effective energy efficiency opportunities are widely available for meeting future energy needs in Massachusetts and the region. A recent report by the New England Energy Policy Council estimated the technical potential for energy efficiency improvements, and concluded that New England could meet between 35 and 57 percent of its total electricity needs over the next twenty years through aggressive energy efficiency investments. Future energy efficiency opportunities fall into three general categories: retrofit, new energy uses, and new technologies.

Retrofitting existing buildings and replacing

existing appliances with more energy efficient devices offer substantial conservation potential immediately. For example, in 1986, Massachusetts state government retained an energy service company to improve the efficiency of two of its large office buildings in downtown Boston, the McCormack and Saltonstall buildings. The combined energy bill for the two buildings was three million dollars per year. As a result of installing equipment such as timers on lighting, and changing some maintenance procedures, their combined energy bill has been reduced by over $840,000 per year. Similar savings have also been achieved at other state facilities over the past two years. The success of this effort has led to a decision by the state to retrofit as many buildings as possible as soon as possible.

New buildings, new industries, and new appliances are the major contributors to increasing energy demand. These new uses provide some of the best opportunities for cost-effective conservation, because it is less expensive to design an efficient building than it is to retrofit one. Northeast Utilities in Connecticut has recently instituted a program where the utility will pay developers the incremental costs of energy efficient designs in new commercial buildings. The program requires that building designs be substantially more efficient than what is required by the building code. The advantage of such a program is that neither the developer nor the energy user needs to pay more for the building; the utility pays and saves energy at much lower cost than it could generate it from power plants. Discussions now under way with

Massachusetts' utilities may result in the implementation of a similar program.

It is important that utilities aggressively promote efficiency for new buildings and appliances now because cost-effective opportunities may be lost forever if inefficient new uses are allowed to be installed. Opportunities for conservation through new uses will always be available, and will be greatest at the time of greatest need -- when growth in these new uses, and consequently customer demand, is high.

New technologies for improving energy efficiency are constantly being developed, expanding opportunities for and reducing the costs of conservation. Often, these new technologies offer additional advantages for the user. For example, efficient lamps can also provide better quality lighting; bulbs that last five times longer, thereby reducing maintenance costs required to replace bulbs; and less heat than conventional lights, thereby reducing cooling requirements. Ongoing new energy efficiency technology developments will ensure that cost-effective conservation opportunities will exist well into the future for both retrofit and new energy uses.

3. The Utilities' Role in Developing Energy Efficiency

a. Including Energy Efficiency In Power Supply Planning

Utilities should fully consider energy efficiency options in their planning for new power supplies. When a utility is selecting among resource options for meeting future customer demand, conservation and load management programs must be evaluated side-by-side with power plants and other supply

options against an agreed upon set of criteria, e.g., cost, reliability, and environmental and social impacts. Given the advantages that energy efficiency has over other supply options in most of these areas, full integration of efficiency in utilities' power supply planning should result in substantial conservation development, along with lower utility operating costs.

Utilities can pursue energy efficiency by providing information, financial incentives, equipment, and technical and other assistance to their customers. Utilities can create energy savings by offering rebates to customers who purchase efficient appliances. Utility companies can also identify potential efficiency improvements for customers through technical audits, and then assist them with the costs required to make the improvements. In addition, utilities can coordinate arrangements between customers and energy service companies, where the service company performs the technical work required to make efficiency improvements and all three parties share in the energy savings. Such incentives and financing arrangements can be structured so that utilities pay less for the energy saved than they would have paid for generating an equivalent amount. Utilities can draw from many possible marketing techniques and programs for making energy efficiency a reality. These should be viewed collectively as an energy resource option similar to power plants.

Comprehensive utility investment in energy efficiency does work. A recent survey by the Investor Responsibility Research Center found that aggressive

conservation programs at six of the largest electric utilities in the United States have saved 7,240 megawatts of generating capacity at less than a fifth of the cost for new plant construction.

However, historically most electric and gas utilities have not fully included energy efficiency in their resource plans, in part because conservation has been viewed as contrary to their primary traditional business objective of selling electricity or gas. Utilities have also found it difficult to overcome internal institutional impediments to effective efficiency development. However, in recent years, more electric and gas utilities have come to recognize that customers do not desire their product -- electricity or gas -- for itself, but for the services it can provide -- heat, lighting, motor drive. Customers care less about how much electricity or gas they consume than receiving the services the energy provides at an affordable price. In order for utilities to provide adequate energy services at least cost, they will have to include all cost-effective energy efficiency in their power supply plans.

b. Direct Investment in Energy Efficiency

In the past, many utilities limited their conservation efforts to simply disseminating information to customers about ways in which they could reduce their bills. More recently, utilities have offered financial rebates to stimulate customer investments in energy efficient devices. Such efforts have met with limited success because they require action and investments by customers. These types of programs

have only been able to influence a very small percentage of utility customers.

In order to be more successful, energy efficiency programs require "direct investment", where utilities take aggressive direct action and make considerable investments in order to reach more customers and ensure that conservation measures are implemented. The Hood River Conservation Project in Oregon is an example of a successful direct investment effort where utilities installed sophisticated and comprehensive weatherization measures, at no cost to homeowners. As a result, they were able to provide substantial savings for 95 percent of targeted customers.

Direct investment efforts for energy efficiency are comparable to utility efforts for power plant construction: aggressive planning, action, and investment are necessary to make the resource come to fruition. Just as utilities invest millions, or billions, of dollars and substantial staff resources in power plants, they should invest comparable amounts of money and resources to save energy from efficiency improvements. For instance, a utility can directly invest in efficiency in a commercial customer's building by providing the technical staff and financing to design and install appropriate efficiency improvements, such as new lighting equipment and HVAC systems. In this way, it will be assured of acquiring substantial energy savings. Such direct investments can result in savings which cost substantially less than an equivalent amount of energy from a power plant.

The direct investment approach to utility efficiency

programs is necessary because customers are unlikely to develop the full potential for conservation on their own. While customers have certain economic incentives to invest in conservation, experience has shown that many obstacles limit customers from achieving what would be the cost-effective level of conservation from the utilities' point of view. These obstacles include:

- **Insufficient direct benefits.** Utilities are in the business of providing energy services, while customers have other interests. In general, customers require a much shorter payback period, i.e., a greater return, for conservation investments than do utilities. In addition, conservation allows utilities to avoid investments in new power plants, with all the attendant risks and costs, a benefit not directly perceived by customers.
- **Lack of information.** Customers' access to conservation-related information is limited. Information regarding the savings, costs, availability and reliability of conservation measures is essential for making cost-effective efficiency investments. Utilities can act as a central data base for energy efficiency information.
- **Lack of control.** Commercial and residential renters are often reluctant to make capital investments in their landlords' property to

reduce their electricity costs. At the same time, landlords have little incentive to pay for conservation measures if they are not responsible for paying energy bills.

- o **Financing limitations.** Most utility customers do not have the same access to capital that utilities do. Customers that do have access to capital often prefer to devote it to their principal area of business or interest.
- o **Skepticism of performance.** Because of their lack of familiarity with energy efficiency options, many customers are concerned about maintaining their existing quality of service after conservation measures have been installed.

The utilities must accompany direct investment with effective marketing. As with any consumer product, energy efficiency programs must be packaged and marketed effectively. Though some have argued that conservation has little appeal for customers, when a good program is marketed, supply can hardly keep up with demand for it. For example, over the past two years, EOER has designed and marketed a zero-interest loan program for middle- and lower-income residential customers to make energy conservation improvements to their homes. In an era of low oil prices, the program could easily have been ignored by consumers. However, by packaging it as one-stop-shopping for information, financing, and quality control for consumers, EOER's HEAT program has become the most successful residential loan program for efficiency ever in the

United States. In two years, almost 15 thousand Massachusetts households have invested over 66 million dollars of their own money plus 16.5 million dollars in state money for interest payments to make their homes more efficient. However, much more needs to be done.

Direct investment by utilities using well-designed programs is essential for realizing Massachusetts' energy efficiency potential. It is clear that the need, the opportunities, and the rationale for energy efficiency all exist in Massachusetts and the region. The most important effort required to make this valuable resource a substantial source of power for the Commonwealth is direct investment by electric and gas utilities. Utility direct investment must be supported by energy policymakers and regulators. Their task is to adopt and implement a least-cost integrated planning framework which will provide utilities with adequate and fair incentives for energy efficiency investments.

4. The Commonwealth's Efforts to Develop Energy Efficiency

While utility companies are the most appropriate entities for developing energy efficiency, the Commonwealth has a role to play in providing a policy and regulatory framework which promotes cost-effective investment in energy efficiency. Adoption and implementation of a formal least-cost integrated planning process will provide such a framework. However, while this formal process is being established, EOER, the Attorney General's office, Conservation Law Foundation and MassPIRG, parties in the Department of Public Utilities' least-cost planning proceeding, have entered into a collaborative process

with six of the Massachusetts utilities to identify and develop a set of conservation and load management programs for implementation by the utilities. This is the first time that a group of utilities has joined together to design a set of energy efficiency programs at the beginning of the regulatory process. The goal of this collaboration is to develop a consensus on a number of appropriate programs and have Massachusetts' utilities move forward as soon as possible with comprehensive efficiency investments.

There are also efforts that the Commonwealth has made and will continue to make that go beyond providing a supportive policy and regulatory environment. Massachusetts government has taken, and continues to take, appropriate initiatives beyond the HEAT residential loan program to promote energy efficiency. These efforts often take advantage of mechanisms that are not available to utilities, such as legislation, standards, codes, and regulations. They are undertaken with the goal of benefiting both utility customers and the Massachusetts economy in general.

In 1986, the Massachusetts Legislature enacted the Appliance Efficiency Standards Act which set minimum energy efficiency standards for certain appliances sold, installed or offered for sale in the Commonwealth on or after January 1, 1988. The Act applies to refrigerators, freezers, water heaters, showerheads, and fluorescent lamp ballasts and fixtures. The standards are expected to result in as many as 200 megawatts of electricity savings in Massachusetts by the year 2000. In 1988 the Massachusetts legislature expanded the

Act to include standards for lightbulbs used by non-residential customers. Such standards will enable Massachusetts to tap the great potential for cost-effective energy savings available from new lighting technologies.

In 1987, through the efforts of EOER and others, the Commonwealth revised the energy portion of the building construction code to ensure that energy efficiency concepts are incorporated into new building designs. The building code sets standards for both commercial and residential buildings, covering the following systems: the building's exterior envelope; HVAC systems; water heating; electrical distribution systems; and lighting. The revisions to the building code are expected to save 137 megawatts of electricity statewide by the year 2000, with greater savings in later years as more homes are built according to the standards. The new standards took effect on July 1, 1988.

In the coming years the Commonwealth should consider further legislation, standards, codes and regulations to promote energy efficiency. Legislation could be established to create a voluntary home energy rating system. This law would require the development of a service to rate the energy efficiency of homes on a standardized basis. Home sellers could voluntarily offer such audit results as a positive selling point, and potential buyers could ask for the results at the time of purchase. In this way, sellers will have an incentive to maximize their homes' energy efficiency, and buyers will be protected from purchasing "energy guzzlers". Utilitization by government of this type of energy efficiency

mechanisms -- standards, codes and regulations -- is important to complement the efforts of utility companies and to reach opportunities unavailable to them.

5. Summary

Energy efficiency improvements offer many advantages to utilities and their customers over power plants. Conservation and load management investments can provide quick, cheap, clean, and risk-free "power". Efficiency opportunities are abundant in Massachusetts, and will continue to be available well into the future.

The challenge facing Massachusetts' energy planners today is to take full advantage of all available cost-effective energy efficiency opportunities. This will require electric and gas utilities to incorporate energy efficiency options into their resource planning efforts and to adopt aggressive direct investment approaches to developing conservation opportunities. The Commonwealth should continue to promote and enforce appropriate energy efficiency legislation, standards, codes and regulations, in addition to providing a supportive regulatory environment for utility direct investment efforts.

Natural Gas

C. NATURAL GAS

1. Recommendation for Action

Additional pipeline capacity to deliver at least 300 to 400 million cubic feet a day of incremental natural gas supplies to Massachusetts should be built by the early 1990s in order to meet the growing needs of traditional gas customers as well as new electric generation loads. The construction of such new capacity would enhance the Commonwealth's fuel diversity and reliability, provide substantial environmental benefits, enhance inter- and intra-fuel competition and provide an efficient and economic fuel supply source, particularly for power generation.

Ideally, long-term plans for future additions to pipeline capacity should be considered in a comprehensive least-cost integrated planning process that evaluates the appropriateness of gas for particular end-uses side-by-side with other energy sources -- electricity, oil, coal and renewables -- to ensure the overall Massachusetts' energy mix is a least-cost one. However, while the Commonwealth is moving toward implementation of least-cost planning, a comprehensive process has not yet been established. The Massachusetts energy situation requires that action be taken now in several areas to ensure adequate energy supplies for the future. EOER has indentified natural gas as one of the areas where action is necessary to meet short-term energy needs.

Massachusetts needs new pipeline capacity because existing capacity is fully utilized in the peak winter heating season and substantial new peak and year-round loads are expected to materialize over the next decade. In the absence of major additions to pipeline capacity, much of this potential demand may be served instead by alternative fuels, with the resulting fuel mix likely to be less secure, more expensive and

less environmentally desirable. Currently, a number of proposals to expand pipeline capacity to Massachusetts and elsewhere in the Northeast are being considered by the Federal Energy Regulatoy Commission (FERC) in its "open season" proceeding.

2. Background

Massachusetts is currently served by two interstate pipelines: Algonquin Gas Transmission Company, a subsidiary of Texas Eastern Transmission Company, and Tennessee Gas Transmission Company, a subsidiary of Tenneco. Algonquin and Tennessee serve the 14 gas utilities in Massachusetts, as well as numerous gas utilities in other states, transporting gas mainly from producing fields in the southwestern United States. Recently, some gas from western Canada has also appeared in the Commonwealth, imported through the TransCanada Pipeline-Tennessee Gas interchange at Niagara Falls.

There are substantial seasonal variations in gas demand across the region. The capacity of the two pipelines serving Massachusetts is approximately 930 million cubic feet (MMcf) per day. Throughout most of the year, this is more than sufficient to meet existing customer needs. In the winter heating season, however, pipeline capacity is generally inadequate to meet demand. Accordingly, large quantities of liquefied natural gas (LNG) and propane are required to supplement pipeline supplies.

LNG is the primary supplemental fuel used by gas utilities in Massachusetts to meet demand in excess of pipeline capacity during the heating season. Generally, LNG is produced

by converting pipeline gas into a liquid during the summer and storing it in large tanks located throughout the Commonwealth. The LNG is then vaporized and reinjected into the distribution network in the winter as needed. In addition, a number of New England gas companies, including several in Massachusetts, purchase LNG from Distrigas, Inc., a supplier of imported LNG.

Propane is also commonly used in Massachusetts as a peak-shaving fuel during winter cold-snaps, and by residential and commercial users in towns where pipeline gas is not available. Propane is used by one utility, Boston Gas Company, as a feedstock for the production of synthetic natural gas (SNG). The use of supplemental fuels by gas utilities in Massachusetts varies considerably from year to year depending on the weather.

3. Advantages of Increasing Natural Gas Use

Massachusetts would realize a number of benefits from the increased availability of new pipeline gas supplies, including greater fuel diversity, increased reliability, environmental benefits, improved economy and efficiency, and increased competition.

a. Fuel Diversity

An important advantage of increasing natural gas consumption in Massachusetts is to improve the diversity of the Commonwealth's fuel supply mix. Despite substantial progress in reducing its reliance on oil, Massachusetts remains overly dependent on imported oil. A more balanced fuel supply portfolio would reduce the Commonwealth's vulnerability to supply or price disruptions of any single fuel. Greater supply

diversity would also promote inter- and intra-fuel competition and thus would help to keep prices to consumers low in non-crisis periods.

Table 1 and Figure 1 provide a comparison of gas consumption trends in Massachusetts and the United States between 1960 and 1987. The charts indicate that while natural gas use in Massachusetts has risen steadily, both in actual terms and as a percentage of total energy consumed, the Commonwealth's market share of gas continues to lag behind the United States'. In 1986, the last year for which full information is available, gas accounted for 21.3 percent of the primary energy (excluding transportation) consumed by Massachusetts compared with 31.2 percent for the United States as a whole. The equivalent figures for oil usage were 52.6 percent for Massachusetts and 22.4 percent for the United States.

Table 2 presents a sectoral comparison of Massachusetts and United States fuel use in 1986. The market share of gas in Massachusetts lags the United States' average in each sector, with industrial and electric utility gas usage particularly low. There appears to be substantial opportunities to increase the gas share in Massachusetts and thereby improve the diversity of the state's fuel supply mix.

b. Reliability

Reliabilty of supplies is another key component of the Commonwealth's overall energy security. Gas is a highly reliable fuel supply in that existing supplies are currently abundant, substantial new supplies are readily available to

TABLE 1

NATURAL GAS SHARE OF
TOTAL STATIONARY ENERGY CONSUMPTION
1960 - 1987

	MASSACHUSETTS			UNITED STATES		
	Natural Gas (TBTU)	Total Stationary (TBTU)	Gas Market (%)	Natural Gas (TBTU)	Total Stationary (TBTU)	Gas Market (%)
1960	80.3	793.0	10.1	12,026.2	33,196.7	36.2
1965	115.5	931.4	12.4	15,261.6	40,271.7	37.9
1970	148.0	1,062.7	13.9	20,952.3	50,264.8	41.7
1975	154.1	1,007.6	15.3	19,382.5	52,329.5	37.0
1980	184.8	844.0	21.9	19,734.1	56,789.9	34.7
1985	223.4	857.6	26.0	17,322.3	53,896.1	32.1
1986	189.5	890.4	21.3	16,217.3	53,478.2	30.3
1987	251.7	N/A	N/A	16,680.0	54,880.0	30.4

TBTU = trillion BTUs
N/A = not available

Sources: U.S. Department of Energy, Energy Information Agency, State Energy Data Report (May 1988) and Natural Gas Monthly (June 1988)

Figure 1

Natural Gas Share of Total Stationary Energy Consumption 1960 - 1987

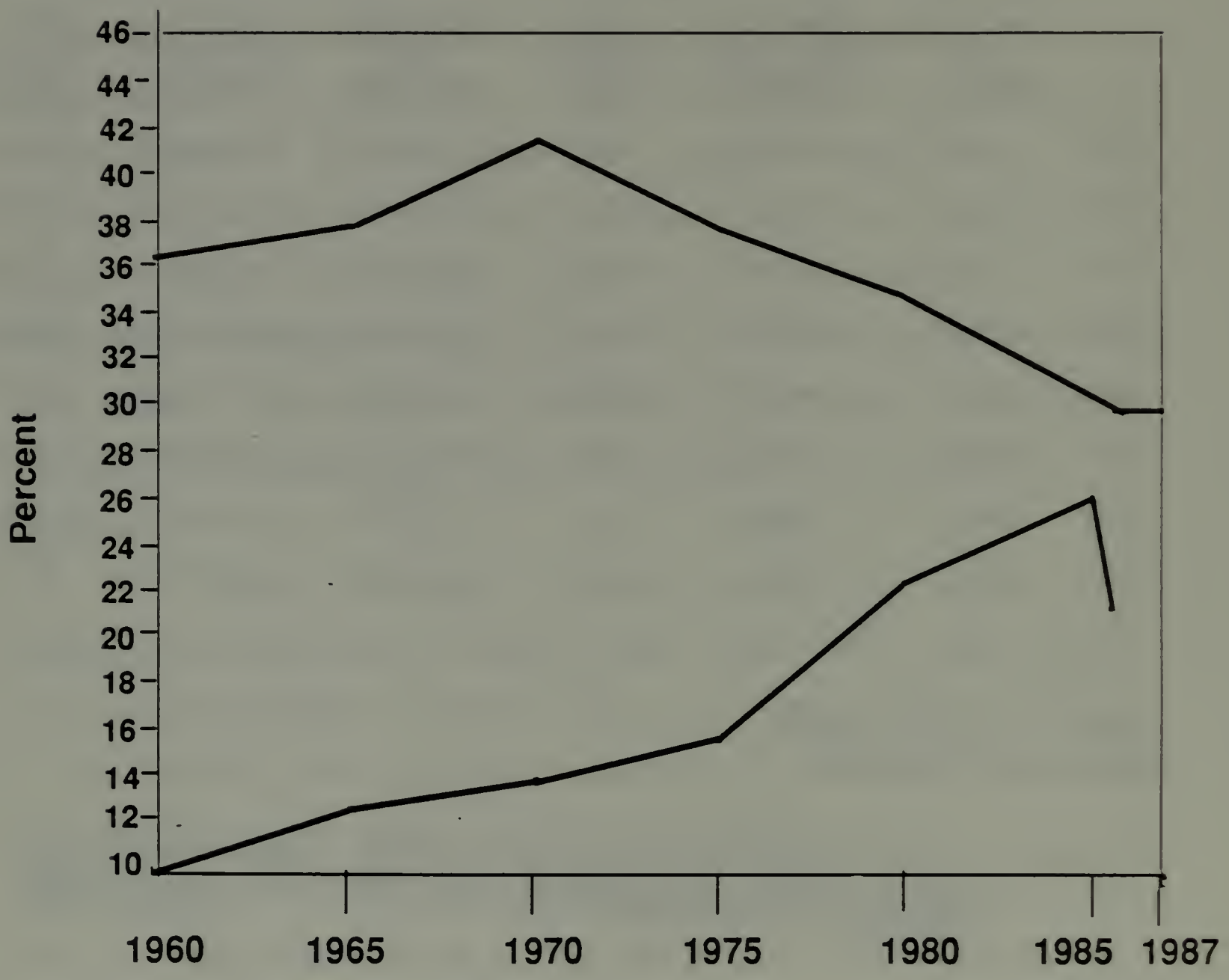

TABLE 2

MARKET SHARE OF GAS AND COMPETING FUELS BY SECTOR
1986

Sector and Fuel	Massachusetts (%)	United States (%)
Residential		
Gas	39.5	50.3
Oil	42.7	17.1
Electricity	17.5	31.7
Other	0.3	0.9
TOTAL	100.0	100.0
Commercial		
Gas	28.5	39.6
Oil	35.1	17.7
Electricity	35.8	40.9
Other	0.6	1.8
TOTAL	100.0	100.0
Industrial		
Gas	16.0	33.4
Oil	60.0	39.5
Electricity	21.0	13.7
Other	3.0	13.4
TOTAL	100.0	100.0
Electric Utility		
Gas	4.0	10.0
Oil	53.9	6.4
Coal	24.7	54.1
Hydro	10.6	12.7
Nuclear	6.8	16.8
TOTAL	100.0	100.0

Source: U.S. Department of Energy (Energy Information Agency), State Energy Data Report (May 1988) and Natural Gas Monthly (February 1988).

meet long term needs, and the delivery of these supplies is not subject to disruption by unreliable suppliers.

Gas consumers in Massachusetts and elsewhere are currently benefiting from the so-called "gas bubble", i.e., a temporary period of excess supply. The American Gas Association estimates that excess domestic production capability at 1.1 trillion cubic feet in 1988, or about 6.5 percent of annual domestic consumption. Two factors are combining to reduce this surplus gas supply in the short run: declining exploration and drilling, the result of low oil and gas prices; and recent growth in gas demand, again due to low gas prices. The domestic gas market is expected to be in approximate balance by the early 1990s.

New supplies are readily available. The United States Department of Energy (DOE) recently estimated that proven gas reserves in the lower 48 states are about 159 trillion cubic feet, or approximately 10 years of supply at current consumption levels and prices. DOE noted that substantial additional supplies of gas exist and will become economic to develop as prices rise. It is estimated that there is a 35 year supply of gas available in the lower 48 states that can be recovered at a price of less than $3.00 per thousand cubic feet, the equivalent of $17 per barrel of crude oil. At higher prices, it is estimated that the total technically recoverable supply of gas in the United States is equivalent to more than 70 years of supply at current usage levels. The existence of substantial gas supplies in Canada and Mexico provides additional assurance of the availability of

long-term reliable sources of natural gas.

Lastly, natural gas supplies are relatively secure. Currently, the United States meets 94 percent of its gas requirements with domestic supplies. The majority of gas imports come from Canada and to a lesser extent from Mexico. A relatively small amount of LNG is imported by tanker from Algeria and Indonesia. This situation compares favorably with oil, where imports accounted for 36 percent of United States consumption in 1987 and are projected to rise to over 50 percent of consumption by the early 1990s. In Massachusetts, about 70 percent of the oil consumed is imported directly or indirectly from outside the United States, almost double that of the nation as a whole.

c. Environmental Benefits

Increasing gas pipeline capacity into Massachusetts in a timely fashion will have favorable consequences for the environment, particularly in terms of air quality. Gas is the cleanest burning and most environmentally benign fossil fuel. In the absence of new pipeline capacity, there would be a greater reliance on other types of fossil fuels, and therefore higher emissions of a wide range of air pollutants, including those that are most closely linked with acid rain (sulfur dioxide) and the greenhouse effect (carbon dioxide). The American Gas Association recently estimated that annual sulfur dioxide, nitrogen oxide and particulate emissions in the northeast United States would rise by 235, 48-58 and 100 thousand tons, respectively, if sufficient incremental pipeline capacity is not added by the early 1990s.

The emissions of sulfur dioxide, the primary cause of acid rain, are near zero for natural gas combustion. Electric utilities and industries are, in many cases, substituting gas for other fossil fuels to comply with state and anticipated federal acid rain legislation. For example, New England Power Company is now attempting to secure firm pipeline capacity in order to convert its Brayton Point #4 plant in Somerset, Massachusetts from oil to gas.

Natural gas is also the fuel of choice for most newly-proposed cogeneration facilities. In many cases, industrial facilities which are not in compliance with state or federal air quality regulations find that gas-fired cogeneration is an effective and relatively inexpensive method to comply with these regulations. In this way, the use of gas can help to retain manufacturing jobs in Massachusetts while at the same time improving air quality. Also, gas may be used in combination with other fuels at existing electric or industrial plants to ensure that these facilities are in overall compliance with environmental regulations.

Natural gas combustion also emits fewer particulates, hydrocarbons and other air pollutants than other fossil fuels. Moreover, the combustion of gas produces neither solid nor nuclear waste.

The primary environmental impact of natural gas is the production of nitrogen oxides during combustion and the local environmental disruptions associated with pipeline construction. Nitrogen oxide, a major component of smog, is produced by the burning of all fossil fuels. The Massachusetts

Department of Environmental Quality Engineering is now setting strict standards which require the use of advanced control technology on new gas-fired facilities in order to minimize such emissions.

While the construction of a major energy facility always has environmental impacts, the impacts associated with the building of gas pipelines are generally short-term, local and small compared to other types of energy production or transmission facilities. These impacts can often be minimized by making the greatest possible use of existing utility rights-of-way.

The greenhouse effect, or global warming, has received considerable public attention in recent months. About half of the greenhouse effect is believed to be due to increased carbon dioxide in the atmosphere, resulting largely from fossil fuel combustion, and to some extent global deforestation. Since natural gas produces proportionally less carbon dioxide than other fossil fuels, its increased use is seen as one possible strategy for countering the greenhouse effect until longer-term solutions can be found.

d. Efficient and Economic Supply Source

Another important benefit of increased natural gas use is that gas would be an efficient and economic supply source, particularly for power generation. New combined-cycle and cogeneration facilities, together with conservation, are expected to meet a major portion of Massachusetts' future electricity needs. Gas is widely considered to be the fuel of choice for these facilities, although "clean coal"

technologies, emerging technologies such as photovoltaics, and other fuels and technologies are expected to play a role in coming years.

Much of the incremental demand for natural gas in Massachusetts is expected to come from new combined-cycle units and cogeneration facilities. The modernization and conversion of existing or retired utility power plants from other fuels to gas is also being considered. A 200 megawatt gas-fired combined-cycle unit would require approximately 40 million cubic feet per day of gas. The limiting factor on the construction of new gas-fired plants or the conversion of existing plants is the availability of pipeline capacity.

Combined-cycle power plants are among the most attractive generation options for meeting New England's future electricity needs. These plants are highly efficient -- 42-50 percent as opposed to 30-35 percent for a typical fossil fuel or nuclear plant. They are also relatively inexpensive -- approximately 6.0¢ per kilowatthour compared to 7.6¢ per kilowatthour for a new coal plant with equivalent controls. Combined cycle plants can operate on either gas or oil, and in the long-term could be converted to burn gasified coal.

Gas is also an economic fuel for cogeneration, the simultaneous production of electricity and steam. The cogeneration market in Massachusetts is growing rapidly, and a significant proportion of these facilities plan to burn natural gas. The plants operate at a high overall efficiency and provide an economic source of steam to the host industry and an economic source of electricity to both the host industry and

electric utility customers.

Existing gas customers would also benefit from new pipeline supplies to the extent that these supplies would displace the use of more expensive supplemental fuels.

e. Increased Competition

Massachusetts, like the rest of New England, is currently served by only two gas pipelines, and many regions of the state are served by just one pipeline, or not at all. Therefore, the addition of a new pipeline would increase competition locally for the transportation and sale of gas and would place downward pressure on the cost of gas from existing suppliers. Increased gas availability would also generate greater inter-fuel competition and thus should help to keep down the prices of other fuels as well.

4. The Prospects for Additional Gas Supplies

a. FERC's "Open Season" Proceeding: An Opportunity to Increase Pipeline Capacity

1) Background

The Federal Energy Regulatory Commission (FERC) is the federal agency responsible for approving pipeline rates and new pipeline construction. In response to a growing interest in new gas for the northeast United States, FERC in July, 1987 established an "open season" to invite new proposals to expand gas pipeline capacity into the region and to eliminate obsolete proposals. FERC received approximately 35 applications by the "open season" filing deadline of January 15, 1988. A number of these applications proposed to expand pipeline capacity into Massachusetts.

Over the past several months, FERC has acted to simplify the open season proceeding by spinning off "discrete" projects into individual proceedings. Discrete projects are those that are judged by FERC to be not competitive with any other projects in the proceeding. Since these projects do not require comparative hearings, they can move forward on their own separate and presumably faster tracks, although each must still obtain FERC's approval before it can be built. To date, FERC has designated several of the projects proposed for Massachusetts as discrete. Together, they will provide incremental pipeline capacity of about 200 MMcf/day to the Commonwealth, and are expected to be approved and on-line by 1989 or 1990.

The remaining projects, which include the bulk of the new gas supplies proposed for Massachusetts, have been the focus of settlement discussions during the summer and fall of 1988. The aim of these discussions is to expedite the construction of new capacity to the Northeast by allowing the various parties an opportunity to reach a compromise among themselves rather than waiting for the potentially lengthy FERC comparative hearings. To date, settlement discussions have been somewhat successful in that they have brought about a partial consolidation of projects. As of November 1988, a number of settlement proposals exist, but no consensus had emerged in support of a single proposal. If a broadly accepted settlement is not achieved, comparative hearings may be required to determine which project(s) go forward.

2) Massachusetts' Role

The public sector in Massachusetts is playing an active role in the "open season" hearings at FERC. EOER, the Energy Facilities Siting Council and the Department of Public Utilities have presented joint comments to FERC on a number of procedural and substantive issues. Massachusetts has been in regular contact with industry representatives and public officials from other states and is also participating actively in coordinating efforts at the regional level.

Massachusetts favors a settlement approach as the best, and perhaps only, means of meeting the urgent needs of Northeast consumers for additional pipeline supplies in a timely manner. Thus, the Commonwealth plans to continue to press for an early settlement that will ensure an adequate, low-cost supply of gas for Massachusetts and an equitable distribution of supply among various states and end-users.

Table 3 presents a summary of the gas volumes requested by Massachusetts' gas utilities and electricity generation facilities in the "open season" filings after eliminating all known customer duplications. As shown in the table, the total distinct volume of gas requested by Massachusetts firms in the "open season" is 627.2 MMcf/day. In the event that all of this capacity were approved, it would constitute a 68 percent increase in the natural gas pipeline capacity serving the Commonwealth.

In addition to the cogeneration and independent power producer demand identified explicitly in Table 3, some portion of the supplies requested by Massachusetts' gas

TABLE 3

MASSACHUSETTS FIRMS REQUESTING GAS
IN OPEN SEASON PROPOSALS

Firm Type	Number of Firms	Net Requested Volume (MMcf/day)	Electricity Capacity[1] (MW)
Gas Utilities	9	192.3	N/A
Electric Utilities	1	95.0	450
Cogenerators and Independent Power Producers	11	339.9	1546
TOTAL	21	627.2	1996

1. Does not include any resale of gas to cogenerators by gas utilities. The proposed 1546 MW of electricity capacity for cogenerators and independent power producers is incremental generation capacity. The 450 MW of electric utility capacity represents the conversion of an existing Massachusetts power plant from oil to gas to meet state acid rain emission limits, and thus would not represent an incremental addition to capacity.

utilities are intended for resale to cogeneration and independent power projects. The degree of overlap between these volumes is not certain, but it is likely that some overlap does exist. Massachusetts' gas utilities do, however, clearly require additional pipeline supplies to meet the growing needs of their non-electric power customers as well as for new cogeneration and independent power projects. There are also a number of proposed gas-fired cogeneration and independent power plants in Massachusetts which are not yet included in any "open season" project.

b. Anticipated Massachusetts Gas Demand

EOER does not anticipate that all of the gas volumes requested by Massachusetts firms in the open season will be required due to the likelihood that some redundancy exists in these requests. Rather, EOER anticipates a need for at least 300 to 400 MMcf/day of additional pipeline capacity to serve the Commonwealth by the early 1990s. Modest growth is forseen for the residential, commercial and industrial sectors; the focus of growth is expected to be in the electric power sector. A significant proportion of the increase in the electric power sector's demand for gas is expected to occur in the early 1990s as new gas-fired cogeneration facilities and power plants come on-line or switch to gas. The primary reasons for this projected growth in gas use by the electric power sector are stricter air quality regulations and the opportunity to minimize cost and risk by building relatively small, efficient, and low capital cost combined-cycle and cogeneration facilities.

One new market for gas expected to emerge in the next decade is gas cooling for commercial and industrial buildings. Gas air conditioning (and combination cooling-heating systems) is a cost-competitive alternative to electric cooling and heating, particularly for commercial cooling applications ranging from 30 to 500 tons of capacity. Although competitive on a life-cycle cost basis, the major barrier at present to the more extensive use of gas air conditioning is the high capital cost of these units relative to electric units. The more extensive use of gas air conditioning would help to hold down peak summer electric loads, thus reducing the need for new power plant capacity. It would also help to utilize pipeline capacity more fully in the summer when gas demand is low. Thus, the use of gas air conditioning would benefit both gas and electric ratepayers. These benefits are expected to be more explicitly recognized as Massachusetts' utilities adopt more comprehensive least-cost integrated planning processes.

5. Strategies for Meeting Expected Gas Demand

The bulk of the gas requested by Massachusetts firms in the "open season" is required to fuel new electric power plants beginning in the early 1990s. With the exception of the 200 MMcf/day from the projects designated by FERC as discrete, it is not yet clear which of the proposed projects will be approved and whether these will be available to serve the region in a timely fashion. The current FERC time schedule would not permit the addition of substantial new pipeline capacity prior to 1994 or 1995 unless a generally agreed upon

settlement can be worked out among the various parties. If such a settlement is reached in the fall of 1988, the prospects are good that Massachusetts will obtain its needed additional pipeline supplies by 1991 or 1992. If, however, settlement negotiations fail, Massachusetts may not obtain all of its needed pipeline supplies until the mid-1990s.

For many proposed cogeneration facilities the inability to secure firm pipeline supplies by a given date may lead to project cancellation, because investors are understandably reluctant to finance such projects in the absence of secure long-term fuel supplies. It may be possible for some of these projects to secure financing based on the short-term use of interruptible gas combined with the use of an alternative fuel, such as oil, LNG or propane, in the winter and the long-term promise of firm pipeline gas supplies. The winter heating season, however, is also the peak demand period for oil, LNG and propane, and the large potential aggregate demands of cogeneration facilities could conceivably strain the existing local supply infrastructure for these fuels. Moreover, the use of oil in most of these facilities is generally expected to be severely limited by state air quality regulations and operational considerations.

If substantial new pipeline capacity cannnot be made available in a timely manner, it will be incumbent on utilities to place a greater emphasis on conservation of both electricity and gas. Under a least-cost integrated planning approach it is likely that gas utilities will find it economic to pursue additional conservation opportunities, thus allowing utilities

to make more efficient use of existing pipeline capacity. Given the seasonality of gas demand, it is likely that heating-related conservation investments such as more efficient furnaces and improved insulation will have the greatest impact on demand. Such investments will improve the gas industry's load factor resulting in internal savings. Also, to the extent that gas is used to generate electricity, electricity conservation will also help to reduce the need for additional pipeline capacity. Even with aggressive conservation efforts, however, substantial additions to existing pipeline capacity will be needed to meet Massachusetts' future energy requirements in an economic and efficient manner.

6. Summary

There is a large new potential market for gas in Massachusetts but this potential market can be served only if incremental pipeline capacity on the order of 300 to 400 MMcf/day is sited and built by the early 1990s. EOER believes it is in the interest of Massachusetts' citizens to pursue this pipeline capacity to meet energy needs over the next several years. In the long-term, additional natural gas pipeline capacity should be developed within a comprehensive least-cost integrated planning framework.

While gas use by all sectors continues to grow, the bulk of this incremental demand for gas is projected to be in the electric power sector. Both existing power plants, seeking to comply with state and anticipated federal air quality regulations, and a large number of new cogeneration and independent power production facilities have indicated that

firm pipeline gas is their fuel of choice.

A number of benefits associated with the increased use of gas have been identified. Additional pipeline gas supplies would provide greater diversity and reliability to the Massachusetts energy supply mix. Natural gas is clearly superior to supply alternatives in terms of its effect on air quality; its use in place of other fuels is seen as a primary method to control emissions which produce acid rain, the "greenhouse effect" and other forms of pollution. Natural gas is also an efficient and economic fuel supply source, and the construction of new pipeline capacity would enhance inter- and intra-fuel competition, thus placing downward pressure on energy prices for all consumers. Furthermore, while the market price of gas is competitive, gas would clearly be considered an even more attractive fuel choice relative to other supply alternatives if the external costs of energy use were to be taken into account in a comprehensive least-cost integrated planning framework as advocated by EOER.

The addition of new pipeline capacity for Massachusetts and the rest of the Northeast is currently being considered by FERC in its "open season" proceeding. Massachusetts' gas utilities and customers have a large stake in several of the proposed "open season" projects and EOER and other Massachusetts state agencies have been active at FERC in attempting to resolve the proceeding in an equitable and timely manner.

EOER believes that settlement in the "open season" proceeding offers the best hope for the delivery of significant

new volumes of pipeline gas to Massachusetts by the early 1990s. If substantial new pipeline capacity into the Commonwealth is not approved and built in a timely fashion, much of the potential new market for pipeline gas is at risk of being lost to alternative fuels, with the consequence that the benefits of new pipeline supplies would be largely foregone. Supplemental gas supplies and expanded conservation efforts have important roles to play, but it is clear that substantial additions to pipeline capacity are desirable and would benefit Massachusetts' energy consumers.

Cogeneration, Small and Independent Power

D. COGENERATION, SMALL AND INDEPENDENT POWER

1. Recommendation for Action

The Commonwealth should encourage the development of those cogeneration, small and independent power projects which have social and environmental benefits in addition to supplying economic electricity for utility ratepayers. Such projects would utilize existing commercial and industrial sites; improve the competitiveness of Massachusetts commercial and industrial businesses; and minimize environmental impacts.

In October 1988, the Joan Fabrics Corporation in Lowell, Massachusetts began receiving the steam it needs for manufacturing from a plant that will also supply 25 megawatts of electricity generating capacity to Massachusetts' utility grid. The Joan Fabrics Corporation will reduce its annual expenditures for steam by 45 percent, saving the company $345,000 during the cogeneration plant's first year of operation.

For Joan Fabrics, developing a facility which produces electricity and process heat simultaneously was a good business decision. The company's project is not an isolated example. Dozens of Massachusetts hospitals, schools, and manufacturing firms have installed cogeneration equipment. Dozens more are planning to install such equipment in the future. Cogeneration facilities such as Joan Fabrics' result in the more efficient use of fossil fuels, reducing the energy costs of doing business. These investments make Massachusetts firms more competitive. In addition, such projects provide economic electric power for Massachusetts' utility ratepayers.

EOER believes that projects, such as Joan Fabrics', which are directly associated with existing commercial or

industrial firms, provide substantial benefits to the citizens of the Commonwealth and should be encouraged. Today, however, these desirable projects are competing to sell power against projects which provide economic electricity, but which do not provide similar social and environmental benefits. If price is the primary consideration in selecting which projects will be given the opportunity to sell power to utilities on a long-term basis, many of the most beneficial projects may not be developed.

EOER recognizes that a wide range of facilities not owned by utilities will have an important role in contributing to Massachusetts' portfolio of electricity supply options. At the same time, EOER believes a solid public policy rationale exists for encouraging the development of projects which directly improve the competitiveness of Massachusetts businesses and generate electricity with minimal environmental impacts. EOER believes the Commonwealth should work to ensure that businesses and utilities consider a range of social and environmental benefits when deciding which projects to develop first.

2. Background

a. The Cogeneration, Small and Independent Power Industry

Electricity generating facilities that are not owned by franchised utilities fall into three categories: cogenerators, small and independent power producers.

Cogenerators sequentially produce two forms of energy, usually electricity and thermal energy (e.g., steam or

hot water). Small power producers generally use technologies which convert an alternative, and sometimes renewable, source of energy into electricity.

Independent power producers are the third major category of non-utility electricity generators. They are an emerging class of projects promoted by entrepreneurial developers. Such projects are generally larger than cogenerators and small power producers, and do not cogenerate or use renewable fuels.

b. Regulation of Cogenerators, Small and Independent Power Producers

In the late 1970s, national energy policy was concerned with diversifying the United States' sources of energy supply and using energy more efficiently. In pursuit of these goals, Congress established its commitment to cogeneration and small power production in provisions of the Public Utility Regulatory Policies Act of 1978 (PURPA). PURPA requires electric utilities to purchase the electricity output of selected cogenerators and small power producers, called qualifying facilities. These qualifying facilities are cogenerators which meet standards regarding the efficient use of fossil fuels and heat output, or small power producers which have 80 megawatts or less of capacity. The implementation of PURPA was left to state public utilities commissions.

In August 1986, responding to EOER's petition, the Massachusetts Department of Public Utilities modified its regulations relating to PURPA. The modified regulations removed several financial and institutional impediments to

cogeneration and small power development. The core of these regulations is an innovative competitive bidding process for selecting among projects competing to sell power to utilities. Under the Massachusetts PURPA regulations, retail utility companies are required to solicit bids for cogeneration and small power generating capacity at least once a year. Utilities must consider both price and other project characteristics, such as size, fuel type, site ownership, and project development, when evaluating bids to select projects from which to buy electricity on a long-term basis.

Independent power producers have received no special regulatory treatment and are regulated as if they were franchised utilities. Recent proposals by the Federal Energy Regulatory Commission, if enacted, would streamline the regulation of independent power producers; however, utilities would not be obligated to purchase electricity from them.

c. The Current Status of Development

Currently, EOER estimates that there are 466 megawatts of cogeneration and small power capacity in Massachusetts, which produce 2,878 gigawatthours of electricity annually on average. This production capacity has increased by 358 megawatts since 1981, when the Department of Public Utilities first promulgated regulations to implement PURPA. Cogeneration, small and independent power capacity could represent approximately 20 percent of Massachusetts' generating capacity by 1995.

The number of projects offered in response to recent utility requests for proposals has been impressive. In every

case, the generating capacity offered by cogenerators and small power producers exceeded the amount sought by several times. In 1987, Boston Edison Company solicited proposals for 200 megawatts of capacity; it received bids for 1,848 megawatts. Eastern Edison Company received almost 180 megawatts of proposals in response to its October 1987 request for 30 megawatts of capacity. Commonwealth Electric Company and Canal Electric Company sought 109 megawatts of capacity in August 1988 and received proposals for roughly 900 megawatts. In the largest response to date in July 1988, New England Power Company received proposals representing 4,780 megawatts of capacity to fill 200 megawatts of need.

Hydropower and oil-fired facilities have traditionally dominated the fuel mix in cogeneration and small power projects. However, in current proposals, gas is the fuel for a majority of the projects. Coal, using emerging clean coal technologies, is expected to be used to a greater extent in the future.

To assess adequately the relative benefits of this diverse and rapidly expanding group of cogeneration, small and independent power projects, utilities must take a broad view of the benefits that these projects offer. The competitive bidding program which Massachusetts has established provides a framework to select the most beneficial projects from among those competing at any one point in time. The challenge now is to ensure that the fullest potential of this system is realized.

3. EOER Initiatives Regarding Cogeneration, Small and Independent Power in Massachusetts

EOER has undertaken several initiatives which it

believes will both stimulate and productively guide the development of cogeneration, small and independent power in Massachusetts in a manner consistent with both a least-cost integrated planning process and Massachusetts' existing competitive bidding system. While some of EOER's initiatives will benefit all such projects, much of the effort is intended to encourage those projects which offer social and environmental benefits in addition to supplying economic electricity for utility ratepayers. The three broad initiatives discussed here will help ensure that the Commonwealth enjoys a secure, affordable and environmentally sound energy future.

a. Improving the Consideration of Social and Environmental Benefits in Project Evaluation

Currently, the cornerstone of Massachusetts' cogeneration and small power policy is the competitive bidding process for soliciting cogeneration and small power project proposals. This competitive bidding policy may be expanded to include independent power producers and other resources, including conservation and load management, in a formal least-cost integrated planning process. While the least-cost process is being developed, EOER is working to ensure that the existing bidding system for cogenerators and small power producers evolves in a manner consistent with least-cost integrated planning principles, by ensuring that a project's social and environmental benefits are taken into account in proposal evaluation and project selection.

1) Encouraging Project Development at Existing Sites

Cogeneration projects developed at existing

commercial and industrial sites have several important benefits which new, stand-alone projects do not possess. First, the development of cogeneration projects at existing sites will reduce the production costs of Massachusetts' manufacturing industries by lowering their energy costs. A firm can both supply its steam or hot water needs and satisfy either a part or all of its electricity demand. Many Massachusetts manufacturing industries, such as paper mills and chemical manufacturing, require large amounts of steam for process heat. Reducing energy costs in these industries will help ensure that they remain competitive, thus preserving manufacturing jobs in the state.

A second benefit, closely related to the first, pertains to the productive use of a cogenerator's thermal output. In some projects, a thermal use is "created" so that the project will obtain qualifying facility status under PURPA and the benefits associated with that designation. Many observers refer to this as the "PURPA machine" phenomenon, a label which indicates that such projects were designed to take advantage of the PURPA legislation and not the efficient use of resources. At existing industrial sites, the need for a cogenerator's thermal output is already clearly established. It is precisely in this setting that the fullest benefits of the sequential production of electrical and thermal energy and efficient fuel use are realized.

Third, the development of projects at existing industrial sites minimizes the problems of siting a new facility. Siting new facilities can be expensive and time

consuming. These problems are minimized when cogeneration equipment is installed in operating industries. While some new permits are generally required, neighbors tend to be more accepting of or neutral toward such projects.

Finally, it is reasonable to expect that projects at existing commercial and industrial sites have a greater chance of being completed. An operating commercial or industrial firm has an interest in completing a new electricity and steam or hot water source on time to keep production running smoothly. One objective of Massachusetts' competitive bidding policy is to select the projects which are most likely to succeed. By accounting explicitly in project evaluation for the benefits regarding the productive use of thermal output, efficient use of fuel and siting, those projects which are the most likely to succeed will be encouraged.

2) Encouraging Fuel Diversity

The security and economic stability of Massachusetts' electricity supply is increased when the state's power production facilities use a variety of fuel sources. This diversity can be encouraged through the emphasis given fuel type in the evaluation of cogeneration and small power projects. To decrease Massachusetts' dependence on imported oil and increase fuel diversity, the use of gas, clean coal, and renewable fuels should be encouraged.

3) Promoting Use Of Renewable Energy Resources

EOER has promoted the use of renewable resources in two aspects of the existing cogeneration and small power

competitive bidding process. First, EOER has supported allowing front-loaded payments to cogenerators and small power producers. Such payments are necessary for the development of many renewable energy projects, because these projects require large initial investments of capital. Under such front-loaded schemes, a utility pays a cogenerator or small power producer a price in the early years of a contract for its power that exceeds the cost the utility would have incurred if it had produced the electricity itself. Then, in the later years of the contract period, payments to the cogenerator or small power producer would be less than the cost of utility-produced electricity. Overall, the total payments to the cogenerator or small power producer would be equal to or less than the total cost of the electricity if the utility had produced it itself. Front-loaded payment schemes pose some risk for utility ratepayers. This risk is largely mitigated by security provisions required of the cogenerator or small power producer to guard utility ratepayers from the impacts of premature closure of the facility.

EOER has also advocated that renewable resource projects receive additional credit when utilities review project proposals. Under the project evaluation criteria contained in recent utility requests for cogeneration and small power proposals, projects could improve their rating if they were powered by renewable energy sources such as biomass, solar, wind, landfill methane gas, or hydro.

b. Improving the Environmental Permitting Process

EOER and the Massachusetts Department of

Environmental Quality Engineering (DEQE) are working together to improve the environmental permitting process for all energy facilities, including cogenerators and small power producers. EOER believes that the permitting process for such projects, which will play a vital role in assuring a secure and affordable supply of electric power, should be facilitated, and is working with DEQE to accomplish this. Vital energy projects, both utility and non-utility, should be considered before projects of less economic importance to the Commonwealth.

c. Creating Additional Opportunities for Cogeneration and Small Power Development

Lastly, EOER is working to minimize missed opportunities for cogeneration and small power development in Massachusetts. Opportunities may be lost because of uncertainty related to the sale of cogenerated power. EOER is considering ways to alleviate this problem for certain types of projects.

1) Standard Rates for Small Projects

Developers of small scale cogeneration and small power projects find it difficult to participate in Massachusetts' competitive bidding process or in extended power sales negotiations with utilities. The relative financial burden of participating in these processes is higher for small projects than for large projects. If the costs of entering the power sales market are too high given a project's size, potentially beneficial projects may be discouraged. This problem was anticipated and the Department of Public Utilities'

regulations provide that standard rates will be available for projects with one megawatt or less of capacity. However, EOER is concerned that this capacity limit may be too low. By making standard rates available to somewhat larger facilities, more projects will be assured of a buyer for their power. EOER is evaluating the desirability of raising this capacity limit and making standard rates available to more projects.

2) **Limited Retail Sales**

EOER believes that in some circumstances it would be beneficial for cogeneration and small power facilities to make retail sales of their power either on-site or to a limited number of customers, in addition to local utilities. Under current law, facilities which make sales of this type are designated as public utilities subject to the regulation that entails. The threat of this designation effectively disallows this type of sales. EOER supports allowing limited retail sales as a way to realize fully the benefits offered by cogeneration and small power projects. EOER has introduced legislation that would allow cogenerators and small power producers to make limited retail sales of up to ten megawatts of their power without being designated as public utilities.

Under current law, electricity generated on a company's property cannot be sold to the company without designation as a utility unless that company partially owns the generating facility. Some firms do not pursue cogeneration or small power opportunities because they do not want to be involved in the ownership of the plant. Allowing limited retail sales would enable independent developers to retain

non-utility status and build and manage cogeneration and small power facilities and sell power to the business which owns the property. The economic desirability of on-site generation versus buying power from the utility grid depends on many site-specific factors. However, it is reasonable to expect that more businesses would pursue cogeneration and small power opportunities if independent firms could own and manage such on-site projects under these conditions.

In addition to resolving issues concerning on-site ownership of cogeneration and small power projects, a retail sales policy could be structured to allow sales to a limited number of neighboring commercial or industrial firms. Currently, cogenerators and small power producers can only sell the electricity not used on-site to utilities. If they could retain non-utility status and sell to neighboring customers, the potential market for their power would be expanded in settings such as industrial parks. An expanded market in these areas would stimulate the development of cogeneration and small power at existing commercial and industrial sites. These are the types of cogeneration and small power projects that EOER seeks to encourage.

Massachusetts' utilities and others have raised several important issues with regard to limited retail sales. Utilities are concerned that cogenerators and small power producers will choose to approach only those customers who are easiest and cheapest to serve, leaving the utility to serve the customers with the most expensive and difficult service needs. In addition, Massachusetts' utilities are concerned about their

obligation to supply power to customers buying from cogenerators and small power producers in times of an emergency failure or routine maintenance.

EOER's approach to retail sales reflects an appreciation of the utilities' concerns. Retail sales by cogenerators and small power producers should be limited so that utilities would not lose significant numbers of customers. Finally, EOER has expressed its willingness to work with the utilities on rate solutions which can address their concerns regarding their obligation to serve all customers, and EOER supports a policy allowing utilities to charge a fair price for backup power and reconnection.

4. Summary

EOER is undertaking several initiatives to achieve its goal of encouraging cogeneration, small and independent power projects with social and environmental benefits in addition to supplying economic electricity to utility ratepayers. In general, EOER's specific policy initiatives reflect two broad objectives.

First, EOER wants the evaluation and selection as a supply resource by utilities of cogeneration, small and independent power projects to be consistent with least-cost integrated planning. Under such a framework, an array of social and environmental benefits are credited in a project's evaluation.

Second, EOER seeks to remove unnecessary barriers to cogeneration, small and independent power projects' entry into the electric power marketplace. EOER and DEQE are working

together to improve the environmental permitting process for power facilities. In addition, EOER is reviewing policies concerning standard rates for small cogeneration and small power facilities, and the restriction on retail sales of their power.

EOER believes that as a result of these initiatives a greater number of projects will be developed that improve the productivity of Massachusetts commercial and industrial businesses; utilize existing commercial and industrial sites; and lessen environmental impacts. EOER believes that these projects must be encouraged, if the fullest benefits of this emerging industry are to be realized in Massachusetts, and Massaschusetts' energy needs are to be met at a reasonable cost and in an environmentally acceptable manner.

New Electric Utility Generation

E. NEW ELECTRIC UTILITY GENERATION

1. Recommendation for Action

New utility generation projects, including power plant sites and technologies, should be identified and proposed now by the Massachusetts utilities where they will improve the reliability, diversity, and flexibility of the utility system; minimize the environmental impacts of electricity generation; and provide insurance against uncertainties with respect to the adequacy of electricity supplies. The criteria used to select projects and determine the order of development should be consistent with the principles of least-cost integrated planning -- including a comprehensive assessment of all possible demand- and supply-side resources. To facilitate the timely selection of projects, EOER supports the implementation of regulations which provide for a coordinated pre-siting and pre-approval process in a least-cost integrated planning context, for new electric utility generation, with periodic review at the Energy Facilities Siting Council and the Department of Public Utilities.

New electric utility generation -- power plants, major transmission facilities, and repowering or life extension at existing plants -- is yet another resource in the utilities' portfolio of supply options. While it has not received as much attention in recent years as some other options -- energy efficiency and non-utility generation -- new utility generation has characteristics that may make it particularly appropriate for meeting utilities' electricity supply needs in some situations. While the characteristics are not unique to utility generation (a gas plant owned by an independent developer is no different technically than one owned by a utility), EOER recognizes that some projects may not be proposed by non-utilities. For example, it is unlikely that an entity other than a utility would develop a power plant on a utility-owned site or build an interregional transmission interconnection. Similarly, utilities may pursue some projects

which are needed because no other entity will or can as well as a utility, and the utilities have the ultimate obligation to serve their customers' needs. The task for utility resource planners, policymakers and regulators is to identify these utility projects and promote the right plant at the right time and place.

2. What is New Electric Utility Generation?

New electric utility generation includes power plants, major transmission facilities, and repowering and life extension work at existing utility power plants, financed and constructed by utility companies.

a. Power Plants

New electric utility power plants are the most obvious example of new utility generation, and traditionally the main focus of electricity supply expansion. These are power plants constructed, owned and operated by (or for) a utility. Today, while new resources have emerged, power plants are still an important option in utility supply portfolios.

New utility generation, where it is being developed, is being built differently than in the past. Now, utilities are looking to modular, flexible power plant technologies and designs as a hedge against the uncertainties and risks associated with power plant construction. Modular power plant designs have shorter construction lead-times and standardized components and can be built in phases to match supply more closely to demand growth. Shorter construction times and standardization also help to reduce costs or at least make them more predictable. In addition, utilities are incorporating

dual fuel capabilities into many new power plant designs to provide them with the flexibility to respond to changing fuel prices and availability. In some cases, this dual fuel capability also helps them to meet increasingly progressive environmental requirements.

Combined-cycle plants can be built in phases, generally beginning with a gas turbine, and as supply needs increase, adding a steam turbine. This is an example of the modular, flexible power plant technologies utilities today are selecting. These plants can operate on gas and oil or, with further additions, "gasified" coal. The Massachusetts Municipal Wholesale Electric Company's Stony Brook plant, completed in 1981 (the last utility plant to be built in Massachusetts), and Northeast Energy Associates' Bellingham plant, to be completed in 1990 (the most recently sited generating facility of its size -- 300 megawatts), are both combined-cycle plants.

Utility plans for new power plants include additional gas-fired combined-cycle facilities and possibly a major new coal plant. Plans for new smaller power plants using clean coal technologies are also being considered.

b. Transmission Facilities

New utility generation includes the construction of major transmission lines, and associated facilities, to bring power from one region to another. The energy supply these transmission lines provide is equivalent to that from a new power plant. By building and paying for the transmission line, and paying the selling utility for the power, the buying

utility is entitled to a certain amount of electricity from the plants on the other end.

"Power by wire" enables utilities to take advantage of regional disparities in the cost and availability of electricity or resources it lacks. For example, there are proposals to construct transmission ties between the Midwest and New England to enable the Midwest to sell excess coal power and develop more of its coal resources. New England benefits when this coal power is cheaper than other resources available here. Transmission ties have already been built between New England and Canada, most notably Hydro Quebec, to enable the New England utilities, including Massachusetts', to increase their fuel diversity by taking advantage of Quebec's vast hydro resources. Transmission interconnections with New York and New Brunswick allow New England to benefit from seasonal variations in demand; others with Nova Scotia are under consideration. While overdependence on transmission must be avoided, the benefits of price, fuel diversity, and seasonal availability from future projects should be recognized.

c. Repowering and Life Extension

"Repowering" or extending the lives of existing power plants can also be considered new electric utility generation. As the costs and uncertainties associated with the construction of new power plants have increased over the last fifteen years, electric utilities have analyzed the option of extending the lives of existing power plants. Studies have shown "plant life extensions" to be one of the most economic sources of new electricity supplies. All of Massachusetts'

utilities have indicated that they plan to pursue this option with respect to many of their existing operating power plants. Plant life extension measures include refurbishing or replacing turbine and generator equipment, undertaking additional maintenance, and the replacement of other power plant machinery. In some cases, this work has accompanied conversions of power plants from one fuel to another -- either oil to coal or oil to natural gas -- to take advantage of lower fuel prices or for environmental reasons. New England Electric System (NEES), the parent company of Massachusetts Electric Company, converted three of its Brayton Point units, located in Somerset, Massachusetts, from oil to coal between 1982 and 1984, and currently plans to convert the fourth unit to natural gas. At the same time, NEES performed (or will perform) work to extend the lives of these plants.

The electric utilities have also begun to explore "repowering" existing power plants. Repowering differs from "plant life extension" in the amount of work to be done on the power plant. Repowering may involve upgrading and replacing existing power plant equipment to improve plant efficiency and/or provide an amount of power substantially greater than had been provided by the old plant. For example, New England Electric System's plans for repowering its Manchester Street station in Providence, Rhode Island, will significantly improve the plant's efficiency and increase its capacity from approximately 150 to 450 megawatts.

3. The Role of New Electric Utility Generation

a. New Utility Generation for Reliability

New utility power plants may be desirable to enhance the reliability of the transmission grid serving Massachusetts. All electric generators (whether utility- or non-utility-owned) provide not only "real power", or what is generally thought of as electricity, to meet the demands of customers, but also what is called "reactive power", which is necessary to maintain the voltage levels and stability of the transmission grid. In the right location, new power plants can enhance the stability of the system. Certain electric end-uses, most notably motors, require reactive power which is measured in "VARs", in addition to real power, measured in watts. Power plants can provide both of these types of power. When motor loads on the electricity system increase, as new equipment is installed over time or when equipment such as fans and air conditioners are switched on during a hot day, the electricity system must provide increasing amounts of reactive power. Voltage levels, which must be maintained within a certain range to ensure proper equipment operation, may begin to drop due to a lack of reactive capacity, endangering the stability and reliability of the transmission grid.

There is increasing evidence that there may be a growing reliability problem in the eastern Massachusetts area of the New England transmission grid due to an inadequate amount of reactive power or an imbalance between local loads and local generating capacity. Almost 40 percent of all of New England's load is located in eastern Massachusetts and Rhode

Island as is a significant portion of New England's generation. However, rapid growth in demand for electricity (especially from equipment that requires reactive as well as real power) has taken place in this area at the same time that some local generation (which could provide the needed reactive power) has performed poorly, and in some cases has been unavailable for extended periods of time. This has caused a reliability problem that is not due to inadequate capacity in New England overall, but rather to insufficient reactive capacity in a particular location.

This situation also imposes restrictions on the utilities in scheduling power plant maintenance. Because of the local need for generation, utility system operators can schedule only a limited number of power plants for maintenance at the same time. Over the year, the fact that New England experiences both winter and summer peaks greatly constrains the ability of the utility system operators to optimize their maintenance scheduling.

The utilities have undertaken a program to reinforce the transmission system against the consequences of the reactive power problem. It involves installing capacitors (equipment which provides reactive power) in banks at transmission substations and switchyards. However, there are indications that this program may not be sufficient. Through the months of June, July and August 1988, the utilities had to reduce voltage and/or ask customers in eastern Massachusetts and Rhode Island to reduce their electricity consumption nine times to ensure the stability of the local electricity system,

despite there being adequate amounts of capacity in New England at most of these times. The utilities should continue to implement their transmission reinforcement program; however, they should keep in mind the reliability benefits associated with new power plants in their accounting of the external benefits and costs of new utility power plants. In areas like eastern Massachusetts, with growing demand and unreliable generation, properly sited new utility power plants may be part of the solution to the occasional system reliability problems that have begun to occur, along with better plant maintenance, capacitors and properly sited non-utility generation.

b. New Utility Generation for Diversity and Flexibility

New utility generation can also add to the diversity and flexibility of the utility system serving Massachusetts. In 1987, oil provided approximately 40 percent of New England's electricity and 54 percent of Massachusetts'. Nuclear power accounted for another 37 percent for New England but only four percent for Massachusetts, due to the continued shutdown of the Pilgrim plant. (In 1985, the last year that Pilgrim operated, nuclear power provided about 18 percent of Massachusetts' generation.) Natural gas- and coal-fired power plants account for only seven and 17 percent regionwide, and 13 and 30 percent for Massachusetts. With imported oil increasing as a percentage of total Massachusetts oil consumption, Massachusetts remains vulnerable to oil price shocks and supply disruptions. Continuing concerns about the safety and reliability of nuclear power may affect its ability to provide Massachusetts with safe and affordable electricity. The

increased use of natural gas and clean coal technologies for both utility and non-utility electricity generation will add to Massachusetts' fuel diversity, as will the use of renewable technologies as they become economical on the commercial market. Utilities, however, may be in the best position to investigate the potential of some of these emerging technologies, such as advanced clean coal and photovoltaics, and to realize the benefits they offer by bringing them to the commercialization stage of development.

The flexibility of the utility system can also be enhanced by properly selected and sited new utility generation. Development of clean-burning thermal plants and renewable technologies can provide the utilities with a generation option if environmental or safety requirements necessitate the closing of older, "dirtier" plants. New generation (including new transmission projects) that is strategically located can provide the utilities with more flexibility in power plant maintenance scheduling by reducing the constraints that now exist on scheduling more than one or two plants out of service in an area. Lastly, new transmission projects and new generation with dual fuel capability, or using fuels that do not now predominate, can provide the utilities with the flexibility to change fuels and reduce the impact of fuel price volatility and supply disruptions on customer costs. While these flexibility and diversity benefits can occur with non-utility generation as well, there may be opportunities for new generation that only utilities can, and therefore should, pursue.

c. New Utility Generation to Meet Environmental Requirements

New utility generation should also be considered to meet new environmental requirements. By 2000, approximately 14 percent (1317 megawatts) of the generating capacity serving Massachusetts customers will be over 40 years old, and almost 40 percent will be over 30 years old. The major portion of this capacity is now oil- or coal-fired. Beginning in 1989, Massachusetts' utilities will have to comply with new state acid rain regulations, and there is the possibility that a national acid rain reduction policy will be implemented in the near future. Regulations are also being promulgated at the state level which require stricter environmental controls on emissions from natural gas-fired power plants. There is continuing concern about the safety of nuclear power and the disposal of high-level radioactive wastes, and growing concern about the "greenhouse effect". While energy efficiency and non-utility generation can make up for the loss of some existing generating capacity, utilities should be exploring new power plant technologies, including coal gasification and photovoltaics, and identifying potential sites now to replace existing "dirty", hazardous, or inefficient power plants.

Utilities should carefully analyze the costs of cleaning up existing power plants, taking into account the costs of new power plants using the best available pollution control technologies. When the external costs of remaining pollutants, along with the higher maintenance and operating costs of older plants, are taken into account, new "clean"

power plants may prove, in certain situations, to be the utilities' best option for meeting customers' electricity needs at a reasonable cost. While utilities should avoid the premature retirement of existing capacity in the absence of adequate supply alternatives, they should begin to evaluate now the cost of developing cleaner supply sources.

Depending on the strength of pending environmental regulations, new power plants, in conjunction with transmission projects, non-utility generation and direct investment in conservation and load management, may prove to be the utilities' most effective and economic option for ensuring adequate future electricity supplies.

d. New Utility Generation as Insurance Against Forecasting and Supply Resource Uncertainty

There are many uncertainties associated with electricity demand forecasting and supply planning. Demand forecasting uncertainties include economic growth rates; fuel prices; the energy efficiency of processes and buildings; and unanticipated technological changes. These factors will affect the amount of energy demanded by utility customers.

On the supply side, utilities also face contingencies. Resources which utilities assumed would be available may not be, for reasons both within and outside the utilities' control. Failure to pursue an effective direct investment approach for achieving energy efficiency may result in less conservation and load management than projected. New regulatory requirements, though desirable and necessary to protect the environment and public health and safety, may

affect the availability of existing plants and those under construction. The timing of new fuel supplies, such as new pipeline natural gas, may affect the availability of both utility and non-utility generation.

The utilities must recognize and address all of these uncertainties and contingencies in their planning to ensure that adequate electricity supplies are available under a range of scenarios. Plans for new utility generation may be part of the utilities' "insurance" policy to minimize the possibility of inadequate electricity supplies. Plans for new transmission lines may be especially appropriate here because of the flexibility they offer. Power can be sold as well as bought, and contracts can be structured to provide electricity on an as-needed schedule. The repowering or life extension of existing plants may also contribute given their relatively shorter lead-times and lower costs. Utilities should explore the possibility of maintaining some plants scheduled for retirement in a condition where they can be reactivated quickly if needed. Properly developed and managed, new utility generation can provide flexible insurance that sufficient electricity supplies will be available despite forecasting and supply resource uncertainty.

4. New Utility Generation, Pre-approval, and Least-cost Integrated Planning

For new utility generation to provide the benefits of reliability, diversity, flexibility, minimization of environmental impact, and insurance against uncertainties and risk, it must be properly identified, sited and developed. A

coherent least-cost integrated planning process, with pre-approval of utility resource plans, can help to ensure that the utilities have selected appropriate generation projects.

To facilitate the timely selection of new utility generation projects, EOER supports the implementation of regulations which provide for a coordinated pre-siting and pre-approval process in a least-cost integrated planning context for new electric utility generation, with periodic review at the Energy Facilities Siting Council and the Department of Public Utilities. In addition, it is EOER's position that new utility generation should be identified now, consistent with the principles of least-cost planning, to ensure that electricity supplies will be adequate to meet present and future needs.

EOER believes that Massachusetts' electric utilities must identify new utility generation projects within a least-cost integrated planning framework, subject to periodic regulatory review, that provides guidelines for comprehensively assessing all of the resource options available to a utility and evaluating them according to the same criteria: direct cost, environmental and social impact, equity, risk and reliability. In this assessment, new utility generation should be credited with the reliability, diversity, flexibility, environmental and insurance benefits it can provide when properly sited and developed. Only in this way can the utilities, their customers and society as a whole be assured that energy resources are being developed and used in the most efficient and cost-effective manner.

As was discussed in detail in Section A of this chapter, EOER has proposed regulations to the Department of Public Utilities to implement the principles of least-cost integrated planning effectively in Massachusetts. This proposal was submitted to the Department of Public Utilities as part of its ongoing proceeding regarding the cost recovery treatment to be given to future utility investments in new power plants. This proceeding was opened in response to utilities' and others' concerns that the regulatory framework within which the utilities operated had implicitly changed, leaving the utilities uncertain about how to plan for adequate future electricity supplies.

The utility companies indicated that they were reluctant to commit themselves to large capital expenditures to acquire new electricity supplies without some guarantee from regulators that they would be able to recover the costs of building new power plants. The utilities stated that they favored the adoption of some kind of pre-approval process for new utility generation. In May 1988, the Department of Public Utilities issued an order, based in part on a proposal by EOER, outlining a pre-approval process for new utility generation. The order further stated that proposals for new utility generation must be consistent with a utility's least-cost integrated supply plan. While new utility generation would be pre-approved by the regulators, it would have to be the least-cost option.

Adoption of a pre-approval process within the context of a formal least-cost integrated planning framework would provide Massachusetts' utilities with the direction they are seeking

from policymakers and regulators. Communication of state priorities, as a reflection of Massachusetts' citizens' concerns, will enable utilities to develop new resources, including appropriate new utility generation, to meet electricity needs in an organized manner.

5. Utility Plans for New Generation

Several utilities are currently including preliminary or firm proposals for new power plants in their long-range supply plans. Together with other utilities in the New England Power Pool (NEPOOL), some are considering investment in new bulk transmission facilities. A brief summary of the individual projects under consideration by the utilities follows.

a. Edgar Station

Boston Edison Company is the owner of the retired Edgar Station site in Weymouth, Massachusetts. The last of the Edgar Station units was retired in 1978. Buildings and old equipment remain on the site. Some transmission facilities are still in use along with two small jet engine units used to generate power at peak times. On March 23, 1988, Boston Edison released a Request for Proposals (RFP) to previously selected engineering firms to design and construct between 300 and 600 megawatts of new generating capacity on the Edgar Station site. The firms were asked to respond with power plant designs and construction cost estimates. The firms were free to recommend the technology to be used and whether they would use any of the existing equipment or buildings still on the site. The proposals were submitted on July 25, 1988 and Boston Edison plans to evaluate them and select a firm to move forward with

the design and licensing and permitting work by December 1988/January 1989. Boston Edison estimates that this work will take about one year to complete. At that point, Boston Edison will assess the need for the capacity that a revitalized Edgar Station could provide and either move forward with construction immediately or project a date in the future when construction would begin.

The approach that Boston Edison is taking with Edgar Station is a novel one that EOER generally supports. Boston Edison's rationale for proceeding with an RFP, followed by a licensing and permitting phase, and if necessary by construction, is that the Edgar Station site, already owned by Boston Edison, can provide a ready increment of new capacity should the need materialize in the future.

In Boston Edison's most recent demand forecast and supply plan filed with the EFSC, it projects no need for new capacity, beyond what is already planned, until 2007. However, Boston Edison recognized, in the analysis underlying its plan, that there were many uncertainties which could move the need for new resources forward or back in time. In addition, other uncertainties exist which were not explicitly recognized by Boston Edison. By pre-permitting and pre-licensing a new power plant at Edgar Station, Boston Edison is reducing the lead time necessary to bring this plant on-line. By doing so, Boston Edison can delay the decision to begin construction to a point in time when it can be more certain that the plant is needed. As it is likely that Boston Edison would not need all of the power the plant could provide in the early years, this advance

planning gives Boston Edison time to market the excess capacity to other utility companies in the region who may need additional capacity for a few years.

A new power plant at Edgar Station could also provide benefits by increasing the reliability of the eastern Massachusetts transmission grid, and adding to fuel diversity and flexibility. Additional generating capacity located in Weymouth in eastern Massachusetts could provide reactive power to help to maintain voltage levels and transmission stability in that area. A new power plant in eastern Massachusetts would also give the utilities more flexibility in scheduling maintenance for the plants located in that area, and depending on the technology and fuel chosen, could add to the utility system's diversity.

b. Manchester Street Repowering

In April 1988, New England Electric System (NEES) which serves Massachusetts through Massachusetts Electric Company, announced plans to repower its Manchester Street station in Providence, Rhode Island, increasing its generating capacity from 150 to 450 megawatts. NEES will retire the three existing boilers at the plant, keep the three existing 50 megawatt steam turbine-generators and add three 100 megawatt combustion turbines and generators. The result will be a new power plant with increased capacity, and efficiency (40 percent versus 30 percent), and which will burn natural gas as its primary fuel. Work on the plant is scheduled to begin in early 1992 and be completed by 1996.

A repowered Manchester Street station will provide

benefits in addition to its increased generating capacity: it will provide additional reactive power in the eastern Massachusetts-Rhode Island area; by using natural gas it will add to fuel diversity; and its increased efficiency will reduce its operating and maintenance costs.

c. Other Projects

Several other utility-sponsored projects with projected on-line dates between 1992 and 2000 are actively being discussed by the Massachusetts and other member utilities of NEPOOL. Three projects receiving attention at this time are: an additional purchase of Hydro Quebec power through Central Maine Power Company; a new power purchase from Nova Scotia to be delivered to NEPOOL via an underwater high voltage DC transmission line from Nova Scotia to a Boston Edison transmission facility in Plymouth, Massachusetts; and a 600 megawatt purchase from New Brunswick using existing and planned transmission facilities.

Hydro Quebec Purchase: In July 1988, Central Maine Power Company signed a contract with Hydro Quebec to purchase up to 900 megawatts of power by 2000, in three phases. In the first phase, from 1992 to 1994, Central Maine Power would purchase up to 400 megawatts, in the second phase from 1995 to 1999, the purchase could increase up to 600 megawatts, and in the third phase from 2000 to 2020, it could increase up to 900 megawatts. Central Maine Power itself does not need all the power and has committed to taking only 100, 200 and 300 megawatts, respectively, in the three phases. Hydro Quebec will be marketing the remainder of the power to

other New England utilities. Central Maine Power has agreed to provide transmission for it to the New Hampshire border. As of November 1988, the Maine Public Utilities Commission is expected to issue a decision approving or disapproving this proposed purchase in January 1989.

Nova Scotia Purchase: This proposal is for the purchase of up to 1200 megawatts of power from Nova Scotia via a 265 mile long underwater high voltage DC (direct current) transmission line from Yarmouth, Nova Scotia to Plymouth, Massachusetts. Project facilities would include four 300 megawatt pulverized coal plants with environmental controls to be located in Sheet Harbour, Nova Scotia; transmission facilities to convert the power from AC (alternating current) to DC in Nova Scotia and vice versa when it reaches Plymouth, Massachusetts; and a 217 mile long transmission line from Sheet Harbour to Yarmouth, Nova Scotia.

Boston Edison Company and the Nova Scotia Power Corporation funded a preliminary feasibility study for this project which was completed in March 1988. Early cost estimates compared favorably with projections of Boston Edison's and other New England companies' costs for new generation. In the proposal, the United States portion of the project would be constructed, financed and operated by the group of utilities which would purchase power from the project. The Canadian portion would be constructed, financed and operated by a Canadian consortium.

A second more detailed feasibility study has been outlined but will not proceed without the support of other

NEPOOL member companies. The utilities have not yet decided whether to undertake it.

New Brunswick Purchase: In September 1988, New Brunswick offered 600 megawatts of power for sale to New England utilities. The sale would be supported by 200 megawatts from New Brunswick's existing Pt. Lepreau I plant; 200 megawatts from a coal plant scheduled to go into operation in 1993; and 200 megawatts from a second thermal plant which could be scheduled to go into operation in 1994 if there is a market for the power in New England. Additional transmission capacity would not be needed initially to transfer the power. New Brunswick is willing to sell the power to individual utilities or a group. Discussions on this sale are just beginning.

6. Summary

New electric utility generation has a role to play in Massachusetts' future electricity supply mix. New utility generation, if properly selected and sited, can contribute to system reliability, diversity and flexibility. It can also minimize the environmental impacts of electricity generation and provide insurance against demand uncertainties and supply resource risk. These beneficial attributes of new utility generation should be taken into account when evaluating new utility generation side-by-side with other electricity demand- and supply-side options available to the utilities. The evaluation should take place within a least-cost integrated planning framework that recognizes the direct and external costs and benefits of each option. The utilities should then

be able to identify, and where appropriate, proceed with construction of the next right plant at the right time and place, thereby helping to ensure the adequacy of Massachusetts' electricity supplies, given a range of contingencies, at a reasonable cost and with minimal environmental impacts.

CHAPTER III

CONCLUSION

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SUMMARY

The energy debate in Massachusetts has focused until recently on the questions of whether Massachusetts needs additional energy and electricity supplies and whether there are resource options which could meet this need. The growing consensus is that the answers to these two questions are yes. Now, the imperative is to move on to the still unanswered questions: how can energy suppliers, policymakers and regulators identify those options which should be developed first, and what actions should be taken to facilitate their development? This report begins to answer these latter two questions.

EOER has laid out a course of action for five "critical path" policy areas to achieve the overall objective of adequate energy supplies for Massachusetts, given a range of contingencies, at a reasonable cost and with minimal environmental impact. These areas are:

1) least cost integrated planning;
2) energy efficiency;
3) natural gas;
4) cogeneration, small and independent power; and
5) new electric utility generation.

LEAST-COST INTEGRATED PLANNING

Adoption of a formal least-cost integrated planning process by policymakers and regulators and its full implementation by the electric utility industry will answer the question of which energy supply resources to develop first. EOER has proposed a least-cost integrated planning regulatory

framework to the Department of Public Utilities which is now in the process of reviewing it.

EOER's proposal addresses the key issues which underlie the question of which supply options to develop first. Specifically, the proposal provides a method for the development of a consensus on which criteria -- reliability, flexibility, diversity, cost, and environmental, economic and social impacts -- are most important and should be used to evaluate the variety of supply options available. It also recognizes that there are many resources best developed by the utilities, for which they must continue to be responsible. EOER's proposal integrates Massachusetts' existing competitive bidding process for small power and cogeneration into a process that provides for all types of resources to bid on a competitive basis. It recognizes that to be effective, least-cost integrated planning requires periodic regulatory review to ensure both regulatory and public consensus on the appropriateness of utility resource plans. Lastly, EOER acknowledges the need to provide utilities with fair and equivalent incentives for expenditures on all types of resources, particularly demand-side options, to ensure that utilities are not biased toward or away from any one particular resource.

With a formal least-cost integrated planning process in place, utilities, policymakers and regulators can then focus on the actions that are needed to facilitate the development of specific options: energy efficiency, natural gas, cogeneration, small and independent power, and new utility generation. Their

development is both necessary and desirable, even in the absence of a formal least-cost integrated planning process, to ensure that Massachusetts' energy supplies are adequate to meet its needs. While a systematic assessment may be more difficult in the absence of a formal least-cost integrated planning framework, in this report EOER has laid out its view of several actions which can be taken now to promote the development of four specific supply options.

ENERGY EFFICIENCY

The full potential of cost-effective energy efficiency can only be achieved through aggressive action and direct investment on the part of Massachusetts' electric and gas utilities. The advantages of and opportunities for cost-effective investment in energy efficiency are well-documented. While the total potential this resource offers may not be clear, it is known that it is substantial. The Massachusetts utilities must begin now to mine it with the commitment they have shown in the past to more traditional electricity supply sources. They are nowhere near exhausting its potential.

The Commonwealth has its own role to play in developing energy efficiency by using mechanisms unavailable to utilities -- standards, codes and regulations. Massachusetts must continue to enforce and upgrade its appliance efficiency and building code standards to ensure that only the most cost-effective and efficient devices and buildings are being added and built. The Commonwealth must also watch for new opportunities where the promulgation of energy efficiency

standards or regulations would benefit Massachusetts energy consumers. In addition, state policymakers and regulators should work to ensure that the policy and regulatory environment provides fair and adequate incentives for utility direct investment.

NATURAL GAS

Massachusetts needs additional pipeline capacity capable of delivering at least 300 to 400 million cubic feet per day of incremental natural gas supplies in order to meet its energy needs economically and efficiently through the 1990s. The availability of additional natural gas supplies will affect the selection of electricity and other energy resource options substantially. Both utility and non-utility power suppliers are relying on the availability of additional natural gas supplies to fuel existing and planned power plants. The availability of more natural gas will also benefit residential, commercial and industrial customers.

EOER, with the Energy Facilities Siting Council and the Department of Public Utilities, is actively pursuing the addition of gas pipeline capacity to serve Massachusetts before the Federal Energy Regulatory Commission, the governmental body responsible for reviewing and approving construction of new pipelines. While the final outcome of those proceedings is not clear, it appears that some new gas supplies will be available in the next few years.

COGENERATION, SMALL AND INDEPENDENT POWER

A cogeneration, small and independent power market has already developed in Massachusetts. Responses to utility

requests for bids to build projects have been overwhelming. The task now is to distinguish the better projects from all those available. The Commonwealth should be encouraging those projects which have social and environmental benefits in addition to supplying economic electricity for utility ratepayers. Projects which use existing commercial and industrial sites, improve the competitiveness of Massachusetts' business and industry, and minimize environmental impacts should be credited with the external benefits they provide. Adoption of a formal least-cost integrated planning process would facilitate the development of these projects. However, EOER has already undertaken several initiatives to achieve this end: improving the consideration given external benefits in Massachusetts' existing bidding process for cogeneration and small power; working with the Department of Environmental Quality Engineering to facilitate all power plant licensing; and promoting policies to minimize missed cogeneration and small power opportunities.

NEW ELECTRIC UTILITY GENERATION

Very little planning for new utility generation has taken place in recent years. It is time now for utilities to identify and select power plant sites and technologies with characteristics which will improve the reliability, diversity, and flexibility of the utility system; minimize the environmental impacts of electricity generation; and provide insurance against uncertainties with respect to the adequacy of supplies. Within a formal least-cost integrated planning framework, utilities will be guided to select new utility

generation with these characteristics and will be aided in their selection of the next right plant at the right time and place.

CLOSING

There is general agreement among the participants in Massachusetts' and New England's energy debate -- energy suppliers, consumers, business, industry, environmental groups, and energy policymakers and regulators -- that there are energy resources potentially available to meet the region's needs. However, the important questions of how to select and pursue the development of these options have not been addressed. **Developing Energy Resources: A Five Point Plan** is EOER's initial response to those questions. It is not the final word; discussion and debate must continue, however action must begin now. If the recommendations for action contained herein are followed, EOER believes Massachusetts citizens, businesses and industries will face a more secure and safe energy future.

EOER plans to move forward on each of the five points of this plan. However, full implementation will require the cooperation of many actors including regulators, utilities, independent energy developers, the Federal Energy Regulatory Commission, conservation vendors, and others. EOER will actively seek that cooperation to ensure an adequate supply of reliable and affordable energy for Massachusetts for the 1990s.